Artificial intelligence in personal development from cradle to grave: a comprehensive review of HRD literature[1] [2]

Received
7th March 2023
Revised
15th May 2023
Accepted
31th January 2024

Francesco Laviola - Nicola Cucari - Harry Novic

Abstract

Framing of the research. *Artificial intelligence (AI) is transforming the way organisations manage human resources, injecting new capabilities into human resource management (HRM). There is a pressing need to examine new and more effective approaches to human resource development (HRD).*

Purpose of the paper. *This paper aims to shed light on current knowledge of AI in the HRD domain, developing a comprehensive view of its role in the employee's journey.*

Methodology. *Keyword co-occurrence analysis and bibliographic coupling analysis were performed on a total of 151 papers published between 2002 and 2022. A similarity visualisation programme (VOSviewer) was used to showcase the results visually.*

Results. *The findings highlight the top five authors, sources, papers, and institutions in terms of the prolificacy of contributions in the field. The relevant contribution of this study is the identification and classification of the main topics and research streams in the academic literature. Five main bibliographic clusters are identified, unveiling the five most prominent topics in the field: i) AI in HR and contextual factors; ii) AI in education and future skills; iii) AI Coaching with chatbots; iv) AI in HR recruitment and training; v) AI in soft skills development.*

Research limitations. *It should be acknowledged that the findings are rooted in one database, Scopus, and only publications in English were considered.*

Managerial implications. *We offer three theoretical and institutional implications for advancing further research on AI in HRD. Furthermore, we outline six major takeaways and future lines of research stemming from our findings, resulting in a novel framework that can also be of practical interest to companies.*

Originality of the paper. *This is the first bibliometric study in the HRD and AI field from the viewpoint of personal development. Thus, we provide a first systematisation of the contributions developed in the last twenty years in this novel field of research.*

[1] This paper is the result of the joint effort of three authors: Francesco Laviola, Nicola Cucari, and Harry Novic. In the manuscript, however, section §1 may be attributed to Nicola Cucari and Francesco Laviola, sections §2, §3, §4 may be attributed to Francesco Laviola, and section §5 may be attributed to Francesco Laviola, Nicola Cucari, and Harry Novic.

[2] This work was financially supported by the Italian Ministry of University and Research under the National Operative Programme on Research and Innovation 2014–2020, Grant number DOT1326HYC-4; Sapienza University of Rome under the University Research Call 2022, Grant number AR1221816C0D000A; Sapienza University of Rome under the University Research Call 2023, Grant number AR123188AC0A2AF4.

sinergie
italian journal of management
Vol. 42, Issue 1, 2024

Key words: *artificial intelligence; human resource management; human resource development; personal development; literature review; bibliometric analysis*

1. Introduction

The advancement of artificial intelligence (AI)-computing technologies that simulate or imitate human-like intelligent behaviour-is transforming the way human resources are managed in organisations, introducing new capabilities in human resource management (HRM) (Sivathanu and Pillai, 2018; Vrontis *et al.*, 2022).

For example, Strohmeier and Piazza (2015) studied six key scenarios of AI in HRM, including turnover prediction using artificial neural networks; candidate search using knowledge-based search engines; staff rostering using genetic algorithms; human resource (HR) sentiment analysis using text mining; resume data acquisition using information extraction; and employee self-service using interactive voice response.

According to Makridakis (2017), the AI revolution seeks to replace, augment, and amplify tasks traditionally performed by humans, thereby becoming a formidable rival to human labour. As a result, AI is poised to support all aspects of human resource development (HRD) (Sivathanu and Pillai, 2018), especially those aspects related to training and development, defined as the "*process of systematically developing expertise in individuals for the purpose of improving performance*" (Swanson, 1995, p. 218). It is crucial to provide employees with opportunities for personal development-"*to acquire and develop valuable resources in the form of skills, abilities and knowledge*" (Fletcher, 2019, p. 5)-within HRM, because it helps to create a competitive advantage (Lee and Bruvold, 2003).

In a rapidly changing economy, companies invest in electronic HR systems that support the personal development of employees and change their approach to learning (Lejeune *et al.*, 2021).

In this context, one critical area is the implementation of appropriate learning strategies for employees. Social and soft skills, as opposed to hard skills, are increasing their importance in the HR scenario, and this paper aims to focus specifically on them, not from the classical perspective of de-skilling or re-skilling necessitated by technological development to avoid job displacement, which is certainly relevant, but from the less established angle of supporting the development of these skills through digital technologies, namely AI. AI can help companies solve these problems by, for example, enabling them to personalise employee career development and training programmes (Zel and Kongar, 2020) or to nurture employees' social and soft skills (Aviv *et al.*, 2021; Nambiar *et al.*, 2017).

Nevertheless, a comprehensive review of AI in personal development research has not yet been conducted. Comprehensiveness implies a special perspective on the topic pursued by this paper, because it refers to the role of AI in all stages of the employee journey, *from cradle to grave*, not limiting its scope to the classic employee lifecycle (like in Nosratabadi *et al.*, 2022) but integrating upstream the experience accumulated by the individual during, for example, university studies, before entering the workforce. This is a gap that needs to be addressed for several reasons.

Firstly, this body of research has been growing rapidly, and the introduction of AI into organisations has sufficiently challenged traditional HRM to warrant research investigation (Bankins, 2021; Stone *et al.*, 2015; Vrontis *et al.*, 2022).

Secondly, this body of research seems fragmented as it is spread across different applications, such as virtual working environment applications (Rahimi *et al.*, 2022) and HR analytics implications (Jiang and Akdere, 2021), or domains such as education (Wollny *et al.*, 2021) and the employee lifecycle (Nosratabadi *et al.*, 2022).

Thirdly, as suggested by Li *et al.* (2023), research needs to focus on the impact of AI at a micro level in organisations.

To address the extant gaps, this study reviewed the literature on AI in HRD from the viewpoint of personal development to answer the following two research questions:

RQ1: *How does artificial intelligence fit into the employee journey in support of their professional and personal development?*

RQ2: *What thematic strands and avenues of knowledge and research are most advocated in academic literature on management and beyond?*

To answer these questions, we analysed 151 papers published from 2002 to 2022. A literature review combined with bibliometric techniques (Donthu *et al.*, 2021; Mukherjee *et al.*, 2022) was applied. Following Mariani *et al.* (2023), we deployed content analysis to illustrate the most recurring topics and research streams, as well as the most promising theoretical, institutional, and practical implications stemming from the literature.

This study contributes to HRD literature in several ways.

Firstly, there is a pressing need to examine new and more effective approaches to HRD (Whysall *et al.*, 2019). Accordingly, the structure of the paper encompasses a range of topics that cluster into five main groups: i) AI in HR and contextual factors; ii) AI in education and future skills; iii) AI Coaching with chatbots; iv) AI in HR recruitment and training; and v) AI in soft skills development.

Secondly, this paper highlights the need for technological investment in personal development regarding both the educational and the organisational spheres. In analysing the literature under such lenses, we adopted a cross-contamination perspective that enriches both domains under the umbrella of AI for the personal development of the individual, whether a student (who will eventually transition into the workforce) or an employee. This can help researchers navigate between these different perspectives.

Thirdly, most of the literature reviews on AI in this domain have taken a qualitative approach (Budhwar *et al.*, 2022; Ravid *et al.*, 2020). In contrast, in the present research we combined the systematic (qualitative) and bibliometric (quantitative) literature review methodologies, thus striving for a comprehensive review approach that encapsulates the strengths of both paradigms. The remainder of the paper is structured into three sections. The next section explores the method and tools used for our research. The following section presents the bibliometric analysis results. Finally, we discuss the investigation and conclude by indicating the managerial implications, limitations, and future avenues of research.

2. Methodology

Inspired by Li *et al.* (2023) and Mariani *et al.* (2023), we deemed it appropriate to adopt a systematic quantitative literature review approach (Tranfield *et al.*, 2003) driven by bibliometric analysis. Bibliometric analysis tends to be more objective and extensive in scope than other types of review (Fan *et al.*, 2022); in combination with a systematic review approach, it allows scholars to provide a "*comprehensive coverage of the literature on the research topic*" (Li *et al.*, 2023, p. 3).

2.1 Search strategy

The primary data source used for this study is Elsevier's Scopus database, typically considered one of the most complete in the business and management discipline (Zupic and Čater, 2015). We employed a search query that involved the title, abstract and keyword fields to identify pertinent and related research (Crossan and Apaydin, 2010; Pisani *et al.*, 2017), using the following search query:

TITLE-ABS-KEY (AI OR "artificial intelligence" OR "intelligent agent" OR "human-agent interaction*" OR "robot-human interaction*" OR "intelligent automation" OR "machine learning" OR "deep learning" OR "neural network*" OR chatbot* OR "AI coach*" OR "AI tutor*" OR "AI mentor*")*
AND
TITLE-ABS-KEY ("human resource develop*" OR "human capital develop*" OR "human resource* improv*" OR "human capital improv*" OR "human capital train*"OR "human resource* train*" OR "human resource* coach*" OR "human capital* coach*" OR "HRD" OR "coaching" OR "personal develop*" OR "soft* skill*" OR "general skill*" OR "life* skill*")*
AND
(PUBYEAR > 1999)
AND
LANGUAGE (ENGLISH)
AND
LIMIT-TO (DOCTYPE, "cp")
OR
LIMIT-TO (DOCTYPE, "ar")
OR
LIMIT-TO (DOCTYPE, "cr")
OR
LIMIT-TO (DOCTYPE, "ch")
OR
LIMIT-TO (DOCTYPE, "re")
OR
LIMIT-TO (DOCTYPE, "bk")

The selection of search terms was informed by Vrontis *et al.* (2022), and two sets of keywords were searched in various combinations using the 'advanced search' function. The first set of keywords consisted of words that

belong to or are related to the AI, machine learning and chatbot domains. The second set of keywords contained words that are relevant to the HR, HRM, coaching and personal development domains. Given the specific perspective pursued by this paper on AI as a support for the development of soft skills and not as a cause of de-skilling, it was deemed appropriate to restrict the research in this regard. When relevant and appropriate, words were searched in both singular and plural forms and contracted and extended forms using the asterisk.

The purpose of such a wide range of keywords was to ensure that the collection of literature was as broad and inclusive as possible. For this reason, we considered all the subject areas of Scopus and the most common types of academic work (articles, conference papers, reviews, books, and book chapters).

2.2 Literature Selection

To identify the articles to include in our review, we conducted a multistep comprehensive search (Haddaway *et al.*, 2022). The overall process is illustrated in Figure 1. The preliminary phase of selection involved screening the titles and abstracts of the resulting records: only those deemed relevant were assessed for eligibility with full-text analysis. This was done in order to skim off non-relevant works at the source-for example, works that cited AI as a buzzword-and at the same time, avoid analysing papers resulting from linguistic ambiguity. As an example of the latter, in the fields of medical and environmental sciences, the acronym HRD represents vastly different concepts compared to HR research, such as homologous recombination deficiency, hyper reflective dots, high-risk drinking, high-resolution density, and high recommended dose. As a result, these works were excluded from this bibliometric literature review.

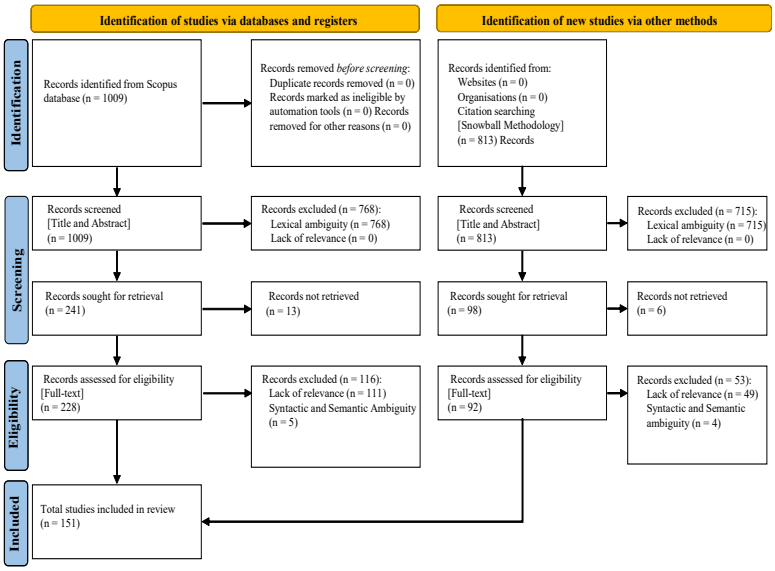
A further selection effort was undertaken to address semantic ambiguity: for example, contributions were excluded in which the word 'development' is related to a totally different meaning from that intended in the present study (e.g. 'software development' in Iftikhar *et al.*, 2021). This preliminary phase of the selection process was crucial, serving to exclude studies that were deemed irrelevant and thus limiting the full-text analysis solely to those studies that demonstrated pertinence to our literature review. During the full-text analysis, several articles were excluded due to lack of relevance, as in van Oorschot *et al.* (2018), because they pursued a different scope, focus or perspective with respect to the present analysis. For example, Man (2020) addressed the topic of HRD from a macro perspective, which sees HRD as a strategic asset for a country's growth, expressing a strictly complementary view to that of the present work, which is instead micro, being more focused on the companies.

Based on the outcome of the first full-text analysis, it was deemed appropriate to expand the scope of exploration through the snowball methodology, utilising Wohlin (2014) as a reference, and thus following both forward and backward snowball approaches. The forward snowball approach selected for evaluation the 300 most relevant papers citing the contributions contained in the sample resulting from the first full-text

analysis; the backward snowball approach selected the 513 most relevant contributions from the reference lists of the papers contained in the sample just mentioned. It seemed appropriate in this case to adopt the relevance criterion pre-determined by Scopus (Elsevier, 2023), considering that it should select papers by similarity instead of simply choosing the most cited, which could hardly have been the most relevant in a niche topic such as the one under investigation in the present work. The corpus of scientific output resulting from the snowball approach was then subject to the same inclusion and exclusion criteria applied to the works resulting from the database search.

The flowchart for the dataset acquisition is shown in Figure 1.

Fig. 1: PRISMA flowchart



Source: Our own elaboration.

2.3 Bibliometric analyses

The final sample of papers (151) was analysed using a similarity visualisation programme (VOSviewer) to showcase some of the results visually. VOSviewer is a professional software designed to visualise intellectual structure (van Eck and Waltman, 2010), and the methods employed are used in the science mapping literature. The analyses and visual representation are of significant importance as they may aid academics and practitioners in comprehending the areas that have been studied more effectively in these types of topic.

The focal analyses performed using VOSviewer were keyword co-occurrence analysis (KCA) and bibliographic coupling analysis (BCA).

KCA is a preliminary thematic analysis and aims to construct a keyword co-occurrence network (KCN), which has been demonstrated to

be useful in exploring the relationship between research topics in various scientific fields. Indeed, as noted by Radhakrishnan *et al.* (2017, p. 2), multiple studies "*have demonstrated the practical value and advantages of KCN-based analysis over traditional literature review approaches*". KCA is suitable for preliminary research work which aims to guide future research efforts by providing "*a knowledge map and insights prior to conducting a rigorous traditional systematic review*" (Radhakrishnan *et al.*, 2017, p. 1). This was accomplished by examining the relationship between keywords (both author and index keywords were selected), using a full counting method. The threshold for the minimum number of occurrences of a single keyword was set to two; two keywords were considered to co-occur if they both appeared in the same title, abstract, or citation context. Furthermore, since the distance between two keywords in a KCN is approximately inversely proportional to their co-occurrence similarity, the clustering function in VOSviewer groups together keywords that frequently co-occur in the sample of publications. This allows a visual representation of the relationships between keywords and an understanding of how they are connected. In other words, the clustering is based on the similarity (relatedness) of the keywords, keywords that have a higher rate of co-occurrence being placed closer together (Bornmann *et al.*, 2018; Waltman *et al.*, 2010). Since this type of analysis "*assumes that words that frequently appear together have a thematic relationship with one another*" (Donthu *et al.*, 2021, p. 289), the results of the KCA were essential to make adequate a priori sense of the results of the subsequent BCA to lead the reasoning and discussion about the actual content of every paper in each cluster from a common thematic foundation.

In contrast, BCA is designed to analyse the intellectual structure of the subject. First introduced by Kessler (1963), bibliographic coupling seeks to identify links between publications that jointly cite another publication. Kessler proposed that bibliographic coupling can be utilised to indicate which papers should be read by whom (Weinberg, 1974) and has five main characteristics: i) it is independent of language and words; ii) no expert judgement is required; iii) it encompasses both the past and the future; iv) it does not produce a static classification for a given paper as the groupings are subject to change based on changes in literature usage; and v) papers that share a unit of coupling with a given paper can be considered its logical references. In contrast to other techniques such as co-citation analysis, bibliographic coupling is forward-looking, as it tends to prioritise younger research and is useful in detecting the connections among research groups. It is also deemed more appropriate for studying emergent literature fields (Liu, 2017). The relatedness of documents in bibliographic coupling is established through the number of shared references. In this method, 'N' documents are considered coupled when they possess 'n' common references, where 'n' is a minimum of one. The connection between these documents is based on the overlap of their reference lists. The greater the number of shared references between two publications, the stronger the relationship between them.

3. Results

3.1 General statistics

The sample of the study consisted of a total of 151 publications by 160 authors affiliated with 160 institutions in 51 countries; they were published in 75 different sources and referred to 2,156 cited references (Table 1). Database interrogation results were updated as of 23 December 2022.

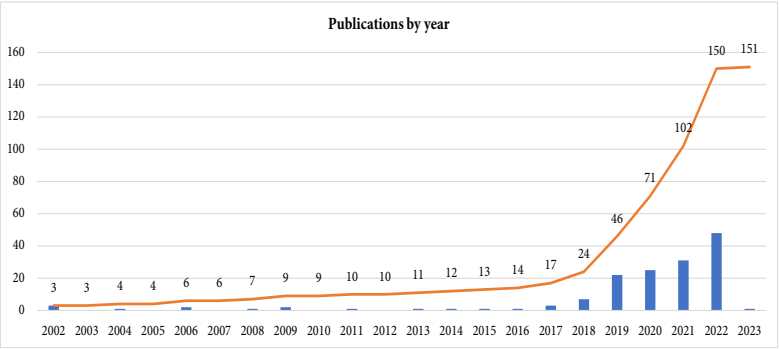
Tab. 1: Descriptive statistics of resulting publications

Statistics of selected sample of papers	
Publications	151
Authors	160
Journals	75
Institutions	160
Countries	51
Cited references	2,156

Source: Our own elaboration on extraction process data.

Figure 2 shows the distribution of publications in our sample by year; it suggests that the scientific field under observation is still in its infancy. The graph shows that publications have more than tripled in three years, from 46 in 2019 to 150 in 2022.

Fig. 2: Publications distribution in the sample by year



Source: Our own elaboration on Scopus data.

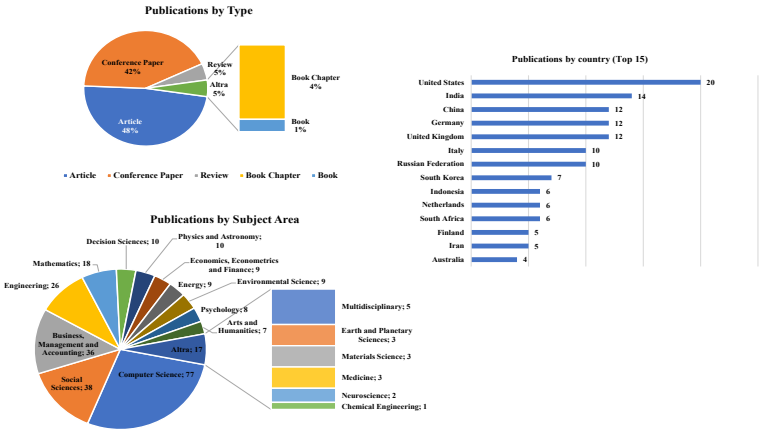
Figure 3 shows the distribution of publications by type, subject area, and country.

The extreme novelty of the field under investigation motivates the consistent presence of conference papers in the sample, since conferences offer swifter publishing mechanisms than journals and are more suitable to discuss novel topics and future scenarios among peer scholars. The significant diversity of contributions in terms of subject area reflects the remarkably cross-cutting nature of AI as a general purpose technology

(GPT) (Bekar *et al.*, 2017), encompassing even very diverse branches of knowledge.

An analysis of the distribution by country shows the dominance of the United States of America with 20 papers, followed by India, China, Germany, and the United Kingdom as the next most prolific countries. However, interest in the field is globally quite widespread, as our sample is populated by authors from 51 countries around the world (Table 1).

Fig. 3: Publication distribution by type, subject area, and country



Source: Our own elaboration on Scopus data.

Tables 2, 3, and 4, respectively, show the most prolific authors, sources and institutions of the papers taken into consideration in the review.

The significant presence of conference papers is confirmed, as three of the top five sources are collections of proceedings. This is undoubtedly due to the aforementioned swifter publishing mechanisms peculiar to conferences, which favour the publication of papers in research streams that are not yet fully established, such as the one investigated.

A fair distribution of scientific production is noted, considering that the top five authors, sources, and institutions in terms of the prolificacy of contributions represent, in the most significant case (top five sources), less than 20 per cent of the total sample. This result symbolises a certain degree of plurality in the scientific landscape focusing on AI in personal and HR development processes.

Tab. 2: Most prolific authors (Top 5)

Most Prolific Authors (Top 5)	Papers
Terblanche, N.	5
Molyn, J.	3
Graßmann, C.	2
Härting, R.C.	2
Jayagopi, D.B.	2

Source: Our own elaboration on Scopus data.

Tab. 3: Most prolific sources (Top 5)

Most Prolific Sources (Top 5)	Papers
Lecture Notes in Computer Science Including Subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics	9
International Journal of Manpower	5
Journal of Physics Conference Series	5
Sustainability Switzerland	5
ACM International Conference Proceeding Series	4

Source: Our own elaboration on Scopus data.

Tab. 4: Most prolific institutions (Top 5)

Most Prolific Institutions (Top 5)	Papers
University of Stellenbosch Business School	4
Vrije Universiteit Amsterdam	3
Oxford Brookes University	3
University of Southern California	3
Texas State University	3

Source: Our own elaboration on Scopus data.

Table 5 shows the most cited sources sorted by number of global citations, while Table 6 presents the most relevant publications in the sample under investigation sorted by normalised citations. Apart from Sivathanu and Pillai's (2018) review paper, the most influential contributions are all recent contributions which, despite their young age and the limited scope of the field, have already accumulated a significant number of citations. This is further evidence of the vibrancy that has characterised research in this area in recent years.

Tab. 5: Most cited sources (Top 5)

Most Cited Sources (Top 5)	Citations
IEEE Intelligent Systems	870
Sustainability (Switzerland)	199
Human Resource Management International Digest	135
Proceedings of the National Conference on Artificial Intelligence	88
Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)	75

Source: Our own elaboration on Scopus data.

Tab. 6: Most influential publications sorted by normalised citations (Top 5)

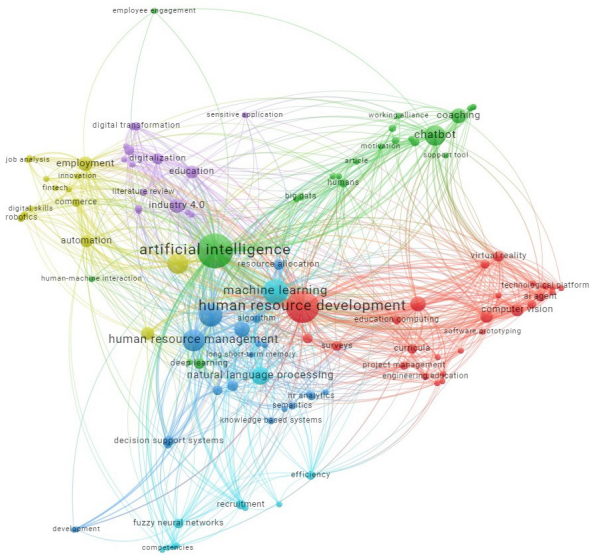
Most influential Publications by normalised citations (Top 5)	Authors	Year	Journal	Citations	Norm. Cit.	Source Type
Impact of artificial intelligence on employees working in industry 4.0 led organizations	Malik N.; Tripathi S.N.; Kar A.K.; Gupta S.	2022	International Journal of Manpower	15	17.14	Article
Influences of the industry 4.0 revolution on the human capital development and consumer behavior	Sima V.; Gheorghe I.G.; Subić J.; Nancu D.	2020	Sustainability (Switzerland)	126	12.91	Article
A study of artificial intelligence on employee performance and work engagement: the moderating role of change leadership	Wijayati D.T.; Rahman Z.; Fahrullah A.; Rahman M.F.W.; Arifah I.D.C.; Kautsar A.	2022	International Journal of Manpower	5	5.71	Article
Smart hr 4.0 - how industry 4.0 is disrupting hr	Sivathanu B.; Pillai R.	2018	Human Resource Management International Digest	135	5.37	Review
Employees' perceptions of the implementation of robotics, artificial intelligence, and automation (raia) on job satisfaction, job security, and employability	Bhargava A.; Bester M.; Bolton L.	2021	Journal of Technology in Behavioral Science	22	4.80	Article

Source: Our own elaboration on Scopus data.

3.2 Keyword Co-occurrence Analysis

The KCN generated by VOSviewer, with the minimum number of each grouping set to ten, consists of 113 keywords interconnected by 1,005 links with a total link strength of 1,623. The visualisation of the network, shown in Figure 4, highlights the presence of six distinct thematic clusters which exhibit some degree of imbalance in terms of their size: at the ends of the spectrum, cluster 1 collects 26 keywords and cluster 6 hosts only 12.

Fig. 4: Keyword co-occurrence network



Source: VOSviewer

Tables 7a to 7f illustrate the keywords contained in each of the six thematic clusters. The number of occurrences of each keyword within the entire sample of papers is displayed, as well as their average seniority, expressed by the weighted average of each keyword occurrence's corresponding year. The frequency of keyword occurrences provides insight into the dominant themes addressed in the reviewed literature, while the average seniority helps visualize the temporal trends present within each thematic strand.

Tab. 7a: KCN cluster 1 (red) keywords list

Keyword	Cluster	Occurrences	Avg. Year
human resource development	1	56	2018
Students	1	12	2020
e-learning	1	8	2013
computer vision	1	8	2014
virtual reality	1	6	2015
AI agent	1	5	2007
classification (of information)	1	5	2020
Curricula	1	5	2020
Surveys	1	5	2020
multi agent systems	1	4	2004
Teaching	1	4	2015
project management	1	4	2017
education computing	1	4	2020
technological platform	1	3	2008
engineering education	1	3	2020
distance learning environment	1	2	2002
technological resources	1	2	2002
software prototyping	1	2	2006
intelligent vehicle highway systems	1	2	2009
virtual humans	1	2	2011
Architecture	1	2	2012
professional aspects	1	2	2014
information use	1	2	2019
professional competencies	1	2	2020
Learning	1	2	2021
Extraction	1	2	2022

Source: Our own elaboration on VOSviewer export data.

Tab. 7b: KCN cluster 2 (green) keywords list

Keyword	Cluster	Occurrences	Avg. Year
artificial intelligence	2	66	2019
Chatbot	2	22	2019
Coaching	2	12	2021
deep learning	2	6	2021
health care	2	4	2019
Humans	2	4	2022
human computer interaction	2	3	2018
big data	2	3	2020
goal attainment	2	3	2022
support tool	2	2	2018
mental health	2	2	2019
Brain	2	2	2020
Competences	2	2	2021
Reflection	2	2	2021
employee engagement	2	2	2021
Motivation	2	2	2021
self-disclosure	2	2	2021
working alliance	2	2	2021
digital storage	2	2	2022
human-machine interaction	2	2	2022
learn+	2	2	2022
Article	2	2	2022
systematic literature review	2	2	2022

Source: Our own elaboration on VOSviewer export data.

Tab. 7c: KCN cluster 3 (blue) keywords list

Keyword	Cluster	Occurrences	Avg. Year
human resources	3	28	2020
human resource management	3	26	2019
neural networks	3	12	20196
decision makers	3	6	2017
decision support systems	3	6	2020
resource allocation	3	5	2021
Managers	3	4	2019
Algorithm	3	4	2017
HR analytics	3	3	2021
Semantics	3	3	2015
knowledge based systems	3	3	2019
employee performance	3	2	2021
Development	3	2	2009
Ontology	3	2	2012
evaluation modelling	3	2	2014
simple multiattribute rating technique (smart)	3	2	2019
image analysis	3	2	2020
long short-term memory	3	2	2020
software design	3	2	2021
Current	3	2	2021
Organisational	3	2	2021

Source: Our own elaboration on VOSviewer export data.

Tab. 7d: KCN cluster 4 (yellow) keywords list

Keyword	Cluster	Occurrences	Avg. Year
soft skills	4	22	2019
Employment	4	11	2021
information management	4	9	2020
Automation	4	8	2021
Commerce	4	4	2019
Robotics	4	3	2020
digital skills	4	2	2019
Innovation	4	2	2019
labor market	4	2	2020
R&D	4	2	2020
Fintech	4	2	2020
skill analysis	4	2	2020
digital economy	4	2	2021
job analysis	4	2	2021
job satisfaction	4	2	2021
support vector machines	4	2	2021

Source: Our own elaboration on VOSviewer export data.

Tab. 7e: KCN cluster 5 (violet) keywords list

Keyword	Cluster	Occurrences	Avg. Year
Industry 4.0	5	11	2020
Education	5	9	2020
Digitalization	5	7	2021
Management	5	5	2017
digital transformation	5	4	2021
data mining	5	3	2019
literature review	5	3	2021
Leadership	5	3	2021
resource management	5	2	2020
higher education	5	2	2020
case study	5	2	2021
South Korea	5	2	2021
strategic approach	5	2	2021
Sustainability	5	2	2021
sensitive application	5	2	2021

Source: Our own elaboration on VOSviewer export data.

Tab. 7f: KCN cluster 6 (light blue) keywords list

Keyword	Cluster	Occurrences	Avg. Year
machine learning	6	33	2020
natural language processing	6	17	2021
fuzzy neural networks	6	5	2016
Recruitment	6	5	2021
Efficiency	6	4	2021
knowledge management	6	2	2016
Competencies	6	2	2016
social networking (online)	6	2	2021
knowledge workers	6	2	2021
lifelong learning	6	2	2021
process automation	6	2	2022
Productivity	6	2	2022

Source: Our own elaboration on VOSviewer export data.

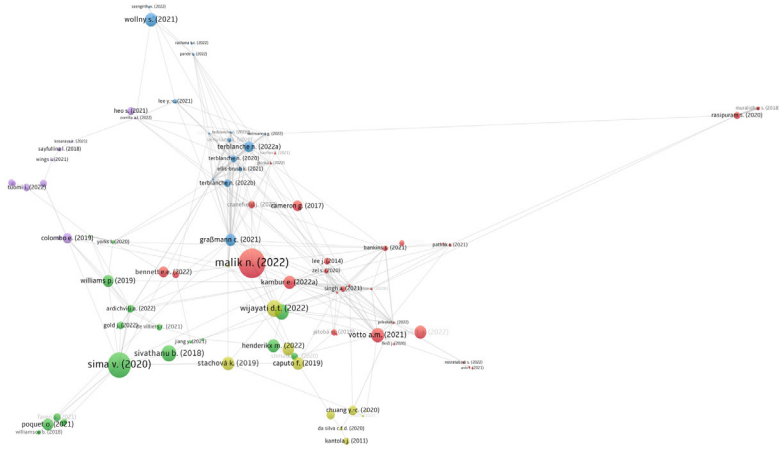
As stated earlier, preliminary results provided by KCA in terms of topics enriched the understanding of thematic clusters resulting from the BCA, described below.

3.3 Bibliographic Coupling Analysis

The bibliographic coupling network (BCN) generated by VOSviewer, the minimum number of each grouping set to ten, consists of 92 (out of 151) papers interconnected by 274 links with a total link strength of 466. The visualisation of the network, as shown in Figure 5, highlights the presence of five distinct bibliographic clusters which exhibit some degree of imbalance in terms of their size: at the ends of the spectrum, cluster 1 collects 31 papers and cluster 5 hosts only 11. The network nodes have been weighted by normalised citations: in this way, the larger ones also represent the most relevant contributions in relation to their seniority. From a brief visual overview of the network, it is apparent that clusters are mostly well-segmented from each other, apart from cluster 2 and cluster 4, which present a discrete overlapping in terms of inter-cluster proximity, meaning that those neighbouring contributions share a fair number of references even though they belong to different clusters. Cluster 3, on the other hand, appears incredibly specialised thematically, and of all the clusters in the BCN presents the highest degree of internal consistency. Such an excellent result could be related to the compactness of the reference literature that specifically insists on AI Coaching and its recency (in terms of mean publication year) compared to the other clusters and the full sample of papers. Intra-cluster distance is in most cases quite small; hence, we can expect a fair amount of coherence between neighbouring papers pertaining to the same cluster. There are some peripheral sub-clusters, however, which exhibit a large intra-cluster distance, strikingly represented by Muralidhar *et al.* (2018) and Nambiar *et al.* (2017) and to a lesser extent by Kuhail *et al.* (2022) and Wollny *et al.* (2021) and Fareri *et al.* (2021), Poquet and de Laat (2021) and Williamson *et al.* (2018). From these contributions, we can

expect less intra-cluster and even less inter-cluster coherence, since they are linked with very few other contributions, either internal or external to their cluster. Fifty-nine contributions out of the total 151 populating the sample under review were not clustered by VOSviewer: this is because they apparently share no reference either with those 92 included in the Figure 5 network or with each other. This testifies to the extreme interdisciplinary nature of scientific research effort on AI, even in a niche area such as the one investigated. Likewise, this attests to the extreme vibrancy of the field, given that many of the contributions in the sample rest on unshared and not yet consolidated literature.

Fig. 5: Bibliographic coupling network



Source: VOSviewer

4. Discussion

4.1 Keyword Co-occurrence Analysis

Cluster 1 (red; AI in students' skills development) largely shows topics concerning students and AI systems to support the development of students' skills, including professional skills. The papers that insist on these themes are mostly institution-oriented in nature. For example, Odrekhivskyy *et al.* (2019) propose a novel approach to the building of intellectual virtual learning environments (IVLE) in the university education system, towards the transformation of the *student learning* journey from a "*teacher-student system into a teacher-IVLE-student system*" (Odrekhivskyy *et al.*, 2019, p. 4). In those systems, AI is embedded in a virtual learning platform and acts as an expert tutor supporting the learning process and evaluating its outcomes, the teacher assuming a more creative role, making final decisions, and managing the double-ended interaction process. Another interesting example is that of Johnson *et al.* (2019), who propose an intelligent tutoring system in the form of a chatbot embedded in an online platform fuelled by

an AI agent that trains and evaluates students' negotiation skills and tactics. The authors show that students interacting with those intelligent agents "*improve in their use of both value-claiming tactics through a combination of practice and personalized feedback*" (Johnson *et al.*, 2019, p. 125).

Cluster 2 (green; AI Coaching with chatbots) addresses the multifaceted theme of coaching with intelligent systems and agents like AI chatbots, with reference to studies that devote such tools to both students (Mai *et al.*, 2021; Terblanche *et al.*, 2022c), and workers and managers (Graßmann and Schermuly, 2021; Schermuly *et al.*, 2021). The former perspective is represented by, for example, Mai *et al.* (2021), who, testing the interaction between a chatbot and university students on exam anxiety, offer useful insights on how the chatbot's disclosure of information about the topic leads to an increase in interaction, self-disclosure and rapport by the user. The authors conclude , in line with other contributions (Justice *et al.*, 2020; Vysotskaya *et al.*, 2020; Yorks *et al.*, 2020), that interaction with a chatbot stimulates users' personal reflection, which is seen as a goal in coaching (Kanatouri, 2020). Such an orientation is usefully synthesised by Graßmann and Schermuly (2021), who offer innovative insights into the use of AI in HRD processes in firms and how it can be used in coaching as a key tool. The authors provide a conceptual systematisation of AI Coaching, defining it as "*a machine-assisted, systematic process to help clients set professional goals and construct solutions to efficiently achieve them*" (Graßmann and Schermuly, 2021, p. 109). The authors argue that AI Coaching systems can learn from large databases of human-to-human coaching processes and become more efficient in helping clients achieve their goals, and they have the advantage of adaptability to the user with whom they interact. However, the study also points out that it is unlikely that AI will completely replace human coaches, and that human coaches are essential at the beginning of the coaching process as AI cannot understand clients' underlying needs and goals.

Cluster 3 (blue; AI and HR analytics) refers to a small number of contributions proposing the implementation of AI-fuelled decision support systems to improve HR allocation, evaluate employee performance and augment HR analytics. An illustration of the application of AI in HR analytics can be seen in the study conducted by Salvetti *et al.* (2022). The authors collaborated with an Italian insurance company to develop a training project that leverages HR analytics and AI. The HR analytics helped to gather valuable information, such as the organisational climate, performance metrics, and the key competencies and skills of each employee. This information was used to design a learning and development plan, which was implemented using an online learning platform featuring mixed-reality simulations enabled by virtual reality (VR) and AI technologies. Another example in this vein is that of Solichin and Hana Saputri (2021), who proposed a method to improve HR allocation through the use of artificial neural networks: based on several HR metrics, their system was able to provide recommendations to the managers of an Indonesian manufacturing company regarding the transfer of employees to other branches, thereby enhancing the efficiency and effectiveness of HR decision-making processes. Another study that stressed this issue

is addressed by Sihombing and colleagues (2019), who implemented a decision support system to assist HRD managers in selection of the best employee in a more effective and efficient way, overcoming the limitations of human biases and bounded rationality.

Cluster 4 (yellow; AI and future skills development) represents the broad themes of soft skills, future skills, and employment scenarios in a deeply and more than ever digitised workplace environment and society in general. For example, De Villiers (2021) proposed a model that can be used by business schools to ensure that graduates can fully contribute to a society impacted by automation and AI by entering the workplace with the requisite skills: the author identifies seven guiding principles to aid educators in the preparation of accounting students for the changes (and challenges) brought by automation and AI. Another example of AI-enabled skills training tools is provided by Rodriguez-Ruiz *et al.* (2021), who implemented natural language processing (NLP) tools based on AI to develop and especially assess students' digital literacy skills. The authors show that use of the proposed NLP tools in the skills assessment phase helps to "*avoid interpretation biases on the part of the teacher and provoke a perception of trust on the part of the students*" (Rodriguez-Ruiz *et al.*, 2021, p. 7), enhancing perception of the validity and reliability of those assessment instruments. A similar tool was proposed by Johnson *et al.* (2020), by followed a novel approach to the teaching of software engineering to Computer Science undergraduate students, based on machine learning (ML) and other digital technologies. The authors demonstrate that using this approach enhances students' career readiness by "*improving preparedness in students for computing job interviews*" (Johnson *et al.*, 2020, p. 10).

Cluster 5 (violet; Industry 4.0 and contextual factors) appears to be at the nexus between cluster 1 and cluster 4: this should not be surprising, since all literature reviews in the sample (Gkinko and Elbanna, 2022; Härting *et al.*, 2021; Kuhail *et al.*, 2022; Nosratabadi *et al.*, 2022; Rahimi *et al.*, 2022; Sima *et al.*, 2020; Sivathanu and Pillai, 2018; Wollny *et al.*, 2021) can be traced back to this cluster. This cluster encompasses a mixture of broad themes treated in other clusters, no contribution apart from reviews pertaining exclusively to it.

Cluster 6 (light blue; Fuzzy logic in HR recruitment and training) refers to a discrete number of contributions in the sample that address the selection and training of human resources with the support of AI systems based on fuzzy logic. For example da Silva *et al.* (2020) leverage the fuzzy sets theory to analyse the HR data of two companies in the electricity sector in Brazil: their model was able to understand the main aspects that must be improved to develop human capital in a more reliable way by reducing the subjectivity due to human evaluation. Since human capital stands as "*one of the main factors of competitive advantage*" (da Silva *et al.*, 2020, p. 5) of companies, this study fuels the belief that the implementation of AI systems in those HR processes effectively yields a competitive advantage. Another technical contribution to this topic is that by Maddumage *et al.* (2019), who proposed an intelligent recruitment system based on NLP techniques supported by a fuzzy inference system. In

particular, their system demonstrated effectiveness in resolving ambiguous scenarios where human evaluators face difficulty making decisions, such as when two candidates receive the same score. The implementation of fuzzy logic in such situations helps to clarify and make a final decision. Similar results are presented by Fachrizal *et al.* (2019), whose e-recruitment system is made to speed up the recruitment process and support HR decisions, and by Michalopoulos *et al.* (2022), with the quantification and prediction of employees' skills and productivity that provides granular metrics for each employee, enabling a more effective employee ranking process. An additional contribution is made by Zhou and colleagues (2022): their method is not limited to the evaluation of candidates' performance, but also provides constructive criticism or suggestions for employees in professional and personal improvement, pushing the AI intervention towards actual HRD.

4.2 Bibliographic Coupling Analysis

Cluster 1 (red; AI in HR and contextual factors) is the most crowded of the five clusters and appears as a large scientific cauldron populated with loosely coupled papers. Although they all deal with the themes of AI in HR in the context of Fourth Industrial Revolution (4IR), there are contributions (Jatobá *et al.*, 2019; Mishra *et al.*, 2021; Nosratabadi *et al.*, 2022; Votto *et al.*, 2021; Xin *et al.*, 2022) that address those themes with a broad perspective on all HR processes encompassing all phases of the employee lifecycle. For the purposes of the present paper, it is useful to highlight, for instance, the findings of Votto and colleagues (2021), who state that AI has the potential to make HR processes more efficient in organisations by providing customised training recommendations based on employees' strengths, interests, and potential for success. Digital training assistants, like AI-based chatbots, can store experienced employees' best practices and monitor performance; they do not possess the in-depth knowledge that experienced workers have, however, and are therefore unable to replace HR trainers completely. In addition, by utilising AI-based VR simulations for mandatory employee training, companies can improve participation, boost efficiency, and lower the costs of training initiatives. These AI-enhanced training tools should be used to supplement employee development, human input providing a personalised touch to employees' onboarding process. Organisations can therefore create smarter learning platforms to improve performance and cultivate talented, innovative, and diverse employees. In this scenario, AI tools must be designed and geared to interact with employees and foster their growth within the company.

Other contributions (Aviv *et al.*, 2021; Muralidhar *et al.*, 2018; Nambiar *et al.*, 2017; Rasipuram and Jayagopi, 2020) focus on AI-based soft skills assessment and training in the workplace. These works mainly highlight the benefits for job candidates and employees deriving from the interaction with AI-based virtual agents, mainly in the form of intelligent chatbots, which enable them to receive automatic and personalised feedback to improve their social and soft skills. Several other studies (Bennett and McWhorter, 2022; Rahimi *et al.*, 2022) further elaborate on the implications of AI in the

virtual training of employees by investigating the transformation of virtual workplace environments and digital employee experience related to AI. For example, digital automation frees up HR teams' time, allowing them to focus on building stronger relationships with employees, managers, and job candidates to better meet their needs (Zel and Kongar, 2020).

Cluster 2 (green; AI in education and future skills) insists on the influence of new technologies on personal development from an educational perspective, and the implications in terms of skills needed for the workplace of the future. In this vein, Sima *et al.* (2020) state that the 4IR exerts a significant influence on human capital development, changing the way work and employment are conducted and the required skills of employees. The rise of automation and robotisation is leading to job losses in repetitive, routine sectors, mainly affecting lower-educated workers. As a result, workers need to acquire new skills to cope with the transformations in production processes and attain greater job satisfaction and security (Bhargava *et al.*, 2021). Digitalisation is affecting the entire economic and social environment, requiring a new set of skills for emerging types of work, and impacting higher education. Labour markets are experiencing a lack of ICT professionals, with a shortage in the advanced manufacturing sector where big data and cybersecurity skills are needed (Sima *et al.*, 2020). To cope with these changes, the authors recommend a combined effort from government, schools and universities, trainers, and companies to adapt curricula and increase the IT skills and innovation skills of the workforce. 4IR, indeed, requires education systems that focus on knowledge beyond what is currently taught and the stimulation of creativity from an early age (Sivathanu and Pillai, 2018). The educational perspective on 4IR is also pursued by Williams (2019), who stresses, for instance, the importance of universities leveraging AI-enabled learning analytics, pre-emptively identifying students at risk of failure and tailoring tutoring initiatives for them. Poquet and de Laat (2021) then address the topic of learning analytics from the broader perspective of lifelong learning, emphasising the opportunity to shift the purpose of learning from human capital to human development, with the focus on capabilities, envisioning "AI-based technologies as a partner in cognition" (Poquet and de Laat 2021, p. 1703).

Cluster 3 (blue; AI Coaching with chatbots) appears incredibly specialised, thematically speaking, focusing on coaching implemented with AI-based chatbots, and presents the highest degree of internal consistency. The contributions in this cluster also appear to be the most coherent and functional for the purposes of this paper. Indeed, this cluster exhibits a dual soul, which in a holistic review paper on AI, encompassing the entire employee journey *from cradle to grave*, is worth emphasising: although the majority of contributions envision AI Coaching in workplace scenarios, some influential papers, like that by Wollny *et al.* (2021), explore AI Coaching activities with intelligent chatbots in the educational context, shaping it in the form of AI tutoring and mentoring. According to Wollny *et al.* (2021), the primary objectives of the implementation of AI-based chatbots in the education sector can be summarised in four categories: i) skills improvement; ii) efficiency of education; iii) enhancement of student motivation; and iv) availability of education. The authors also identify three

different pedagogical roles assignable to AI chatbots in education: learning, assisting, and mentoring. Chatbots can support learning in various ways, such as through integration into the curriculum as a learning aid or through additional offerings outside the classroom. One example of this is a chatbot simulating a virtual pen pal that helps students practise language skills. Chatbots can also assist students by simplifying their daily tasks, such as providing information or automating processes. Additionally, chatbots can serve as mentors to students, focusing on their personal development and encouraging reflection on and assessment of their progress. Other contributions in cluster 3 related to the educational domain (Kuhail *et al.*, 2022; Mai *et al.*, 2021; Terblanche *et al.*, 2022c) are quite consistent in results with Wollny *et al.* (2021), producing pretty similar categorisations and taxonomies for AI tutors and mentors in terms of objectives and roles. Kuhail and colleagues (2022) highlight several limitations of these systems that are worth noting, however: inadequate dataset training, lack of user-centred design, loss of interest over time, lack of feedback, and distractions.

Shifting the focus from the educational to the workplace and professional context, the research by Graßmann and Schermuly (2021) is by far the most prominent, representative and influential paper in cluster 3. The authors present a pioneering examination of the utilisation of AI in HRD and its potential as a crucial tool for coaching. They formulate a systematic framework for AI Coaching, characterising it as a "*machine-assisted, systematic process to help clients set professional goals and construct solutions to efficiently achieve them*" (Graßmann and Schermuly, 2021, p. 109). The authors contend that AI Coaching systems have the capability to acquire knowledge from extensive databases of human-to-human coaching sessions and, as a result, become more proficient in helping clients attain their objectives. The authors assert that AI Coaching chatbot systems have the potential to assist users effectively in navigating various stages of the coaching journey and building strong working alliances. Additionally, these systems can adapt to the unique needs of each user. Nonetheless, the study highlights that complete substitution of human coaches by AI is improbable: human coaches play a vital role in the initial stages of the coaching process as AI is not yet fully capable of comprehending the underlying needs and goals of users if they are implicit or not clearly communicated. According to Graßmann and Schermuly (2021), the use of AI in coaching holds the promise of revolutionising the coaching industry, presenting a cost-effective solution that can reach a wider range of users. As a result, AI Coaching has the potential to become a valuable tool in the field of HRD (Terblanche, 2020), democratising coaching processes in an effective and efficient way, as confirmed by Terblanche *et al.* (2022a). There are three factors that influence the adoption of AI Coaching chatbots: performance expectancy, facilitating conditions, and social influence (Terblanche and Kidd, 2022). In addition, the use of chatbots as coaches provides the benefit of anonymous interaction, particularly in situations in which sensitive information may be disclosed (Terblanche, 2020).

Terblanche *et al.* (2022b) provide further optimistic results on AI Coaching performance and efficacy. Their study involved a comparison between human coaches and an AI chatbot coach. The results showed that

both types of coach were effective in helping users reach their goals, and the AI coach was as effective as human coaches by the end of the trials. This discovery has significant implications, as it suggests that AI Coaching could scale coaching services and potentially grow demand for human coaches, while also potentially replacing human coaches with simplistic, model-based methods. At present, however, as also stated in Graßmann and Schermuly (2021), AI lacks empathy and emotional intelligence, which renders human coaches not completely replaceable.

Finally, Ellis-Brush (2021) presents less enthusiastic results than those in Graßmann and Schermuly (2021), finding that although an AI agent can deliver positive outcomes through a conversational coaching process (e.g. with an improvement in self-resilience), a working alliance between the coachee and the AI coach has not been developed.

Cluster 4 (yellow; AI in HR recruitment and training) exhibits a strong overlap with cluster 2. Stachová *et al.* (2019), for example, draw similar conclusions to those of Sima *et al.* (2020) from their analysis of the challenges and trends of personal development and education in the 4IR scenario. Indeed, the authors confirm the view that "Industry 4.0, and in particular automation that interferes with multiple processes and professions, gradually changes employee education and skills requirements" (Stachová *et al.*, 2019, p. 13). This idea is also supported by Caputo *et al.* (2019) with regard to firms' investment in Big Data and by Wijayati *et al.* (2022), with regard to AI in the workplace.

Perhaps the most relevant contribution in cluster 4 from a managerial perspective is that of Maity (2019), who proposes a model to identify future trends of AI in HR training and development processes. According to the author, the use of AI in knowledge management and employee training and development is becoming increasingly important for organisations. To stay competitive, companies need robust knowledge management practices that are easily accessible to all employees. AI is also playing a crucial role in shifting training and development from classroom-based programmes to personalised, intuitive and adaptive mobile learning experiences. AI has the potential to identify individual learners' characteristics and design training programmes tailored to those characteristics, which is crucial for meeting the current need for individualised training programmes. From a technical point of view, this cluster hosts different contributions to solve the issues of personnel selection and competence improvement (Chuang *et al.*, 2020; da Silva *et al.*, 2020; Michalopoulos *et al.*, 2022; Zhou *et al.*, 2022), to propose to employees alternative training scenarios (Kantola *et al.*, 2011), and to evaluate the success of training initiatives (Kalinouskaya, 2022).

Cluster 5 (violet; AI in soft skills development) is in a sense complementary to cluster 2, in that, again in the common context of 4IR, while the authors included in cluster 2 refer mainly to hard skills (e.g. ICT and data analysis skills), most of the contributions in cluster 5 deal with AI and the assessment and development of soft skills. Although several contributions focus on the educational field, other papers in this cluster appear to be more market-oriented and anchored to the organisational reality of companies. Colombo *et al.* (2019), for example, find that soft and

digital skills tend to moderate the job displacement effects of automation technologies even in highly automatable sectors, complementing the use of machines and software and "*making the job less substitutable*" (Colombo *et al.*, 2019, p. 35). Of an entirely different nature is the work by Sayfullina *et al.* (2018), who propose several approaches based on a neural network model to match the soft skills required by job postings and those present in candidates' CVs. Their proposal offers an effective solution for firms looking to automate the initial phase of candidate evaluation, as the model can effectively disambiguate the soft skills matching process and reduce false positives significantly. This work provides an innovative solution for HR departments looking to streamline their recruitment process and make more informed decisions based on the skills and characteristics of potential candidates. Likewise, the work by Wings *et al.* (2021) presents a practitioner-oriented nature and is aimed at the automatic classification and extraction of hard and, especially, soft skills from candidates' CVs. It starts from the same technical assumptions but achieves a broader purpose than the study by Chang *et al.* (2022), who, leveraging NLP and ML techniques, develop a skills extraction algorithm that can be used to analyse students' skills, university course syllabi and online job postings. By analysing different data sources, the authors provide an initial landscape of skill needs for specific job titles and conduct a within-sector analysis based on programming jobs, the computer science curriculum, and undergraduate students. They find that students have a range of hard and soft skills, but they may not be the ones desired by employers. Additionally, they observe a discrepancy between the skills taught in university courses and those in demand by industry, with a lack of emphasis on soft skills. These findings highlight the importance of aligning university curriculums with the needs of industry to ensure that students are well prepared for their future careers (Kosarava, 2021). The contributions of Pasikowska *et al.* (2013) and Schutt *et al.* (2017) are in line with the development of more practitioner-oriented AI tools and models. These authors propose chatbots and virtual environments enriched by AI techniques directed respectively to patients with mental health issues and health professionals in training.

Table 8 summarises the themes investigated by the authors in each cluster, draws out the major takeaways, and outlines the trajectories that future research should pursue in each thematic strand.

Tab. 8: Major takeaways and future RQs

Cluster	Themes	Major takeaway	Future RQs
Cluster 1	• AI enables improved efficiency of HR processes. • AI can learn best practices from experienced employees. • AI can identify current employees who are most likely to succeed and those who most need support. • AI can inform human decision-makers on HRD strategies.	AI as a partner, not a rival – AI-augmented strategy & decision-making	• What guidelines are needed for the ethical development and implementation of AI systems in the context of HRD? • What are potential users' and companies' perception of AI-augmented HRD processes? • What are the challenges of integrating AI into strategy and decision-making processes within HRD, and how can they be overcome? Is it possible to identify best practices for companies adopting such systems?
Cluster 2	• AI and other digital technologies change labour scenarios and employee skills requirements. • Technological unemployment mainly affects medium-low educated workers. • AI-enabled learning analytics can identify students at risk of failure and tailor tutoring measures. • AI pushes towards the shift from human capital development to personal development of current and future employees.	AI-enabled future skills prediction	• What are the future-proof skills whose development can best be supported by AI? • How does the introduction of AI systems, particularly large language models, into business processes impact the competencies of intellectual and high-skilled workers? Does it enhance or destroy their competencies?
Cluster 3	In education scenarios, AI Coaching assumes three pedagogical roles (teacher, assistant, mentor) and: • Enables skills improvement. • Improves efficiency and availability of education. • Enhances study motivation. In the workplace context, AI acts as goal setter and solution finder in all stages of coaching journey, providing: • A cost-effective coaching solution for companies. • The democratisation of business coaching activities, by reaching a wider audience. • A safe space for reflection, in which sensitive information and emotions can be disclosed by the employee without fear of judgement or repercussions on his/her career	AI Coaching for everyone	• What are the main characteristics that render AI Coaching systems attractive to both students and employees? • What is the role of trust in the acceptance dynamics of AI Coaching systems? Are trust antecedents different between students and employees? • Can modern large language models compensate for the lack of empathy and emotional intelligence of AI Coaching systems reported in the existing literature?
Cluster 4	• AI systems are formidable cost-effective solutions for recruiting and on-boarding processes, but their role is not limited to this. • The development of AI and other digital technologies does not just change the skill sets required of employees but influences the processes of knowledge creation and management. • HRD processes are shifting from one-to-many classroom activities to one-to-one personalised learning experiences supported by AI.	AI in the whole employee lifecycle	• How can AI contribute to the establishment of more robust knowledge management practices? • How can AI be utilised to evaluate the success of training initiatives?
Cluster 5	• AI systems are able to evaluate and train students and employees' soft skills in both educational and workplace contexts. • Soft skills tend to moderate the job displacement effect of automation technologies. • There is a lack of emphasis on soft skills in university courses, even though these are in high demand on the labour market	AI-enabled soft skills education	• How can AI be utilised to identify and bridge the gap in soft skills between university education and labour market demands? • What is students' attitude towards and perception of AI supporting soft skills improvement? • How will educational programmes change with the introduction of AI—for example, in the field of entrepreneurship education?

Source: Our own elaboration.

5. Conclusion

The rapid integration and advancement of AI in various sectors, including economics and management, has ushered in a wealth of both promise and challenges for personal and human resource development.

Although the academic discourse on AI in the economics and management fields is often related to the percentage of traditional jobs that risk being displaced by AI (Acemoglu and Restrepo, 2020; Jackson and Kanik, 2019; Ray and Mookherjee, 2022), it is equally important to stress the benefits of AI in HRD and, more broadly, in HRM.

AI's transformative potential extends to various HRM processes such as recruitment, performance evaluation and employee training. It offers data-driven insights, personalised feedback, and cost-effective solutions, enabling HR professionals to make more impartial decisions and providing

valuable insights into employees' behaviour and preferences. However, the ascent of AI also casts a spotlight on ethical and social considerations, encompassing issues like data privacy, algorithmic bias, job displacement, and technostress.

The implications of integrating AI into the domain of personal and human resource development are manifold, and the shift to the new HR 4.0 paradigm presents both opportunities and challenges for organisations and society as a whole. Beyond its immediate impacts, AI introduces a profound shift in skills requirements and expectations of the contemporary and future workforce. As we confront the demands of 4IR, individuals must adapt, acquiring new competences and skills, namely soft skills.

The ethical challenges associated with the development of AI, which have been posed with increasing insistence in the literature (Bankins, 2021; Gkinko and Elbanna, 2022; Wirtz and Mueller, 2019), seem to be linked increasingly to the concepts of trust and risk. Supranational regulatory bodies such as the European Parliament have recently drawn up guidelines (AI Act, European Parliament, 2023) to ensure the human-centric development of AI, classifying AI systems based on their degree of risk in relation to fundamental rights, among which the right to privacy stands out.

Ultimately, everything seems to be pressing with conviction in the direction of AI development driven by human needs and not simply by technological advancement. Thus, a balanced and well-informed evaluation of the benefits and limitations of AI implementation in HRM is crucial to ensure its responsible and ethical deployment. This underscores the crucial call for a human-centric and ethical approach to AI development and implementation within the realm of personal development and HRD.

5.1 Theoretical and Institutional Implications

Based on the findings of our comprehensive literature review, we offer three theoretical and institutional implications for advancing further research on AI in the HRD literature.

Firstly, our findings enable researchers to understand the scope of research in this field and how these domains can be evaluated from a cross-fertilisation perspective. Researchers may use our results to explain the adoption of AI in HRD using other literature, such as that from the educational domain. The theoretical framework depicted in Figure 6 stems from this perspective. The figure provides an integrated view of major takeaways descending from the several thematic strands populating this multifaceted field of research, bridging them with critical actors at play and new trajectories for future research efforts.

Secondly, our findings provide researchers with critical information on prestigious and influential articles that may be seen as the foundations of this research field. New gaps that need to be filled are related to i) education policy and how these factors can influence social, economic, and educational outcomes; ii) labour dynamics regarding the investigation of the mechanisms of adoption, acceptance, and trust in the educational and employment contexts; and iii) identification of the key components that

should be included in the initial conversation to build trust between the client and the chatbot coach.

Thirdly, our findings highlight ethical issues about the impact of AI on society-wide social sorting and the potential amplification of discrimination and negative effects in the workplace. The impacts of AI adoption include information security, data privacy, drastic changes resulting from digital transformations, and job risk and insecurity. Technostress creators among employees include work overload, job insecurity and complexity (Malik *et al.*, 2022). Consequently, a new ethical framework is needed to guide the application of AI in the HRD area. This study calls for policymakers and professionals engaged in the legal and information technology domains to examine these factors.

5.2 Practical Implications

This study's findings may also be of practical interest to companies. Based on the results, we offer three practical implications for managers to facilitate the implementation and adoption of AI in HRD.

Firstly, practitioners may utilise our research to understand the broad scope of AI's applicability in HRM processes and operations across diverse sectors and managerial domains (Lee *et al.*, 2021; Schermuly *et al.*, 2021).

Secondly, these practitioners may apply the findings of prestigious studies to discuss the design choices and trade-offs that may address major hindrances in AI's implementation in HRD. For example, further investigation is required to determine the optimal balance between human-like features and transparency about limitations. Factors that need consideration are: i) the user's personality type; ii) the level of humanness and anthropomorphic behaviour displayed by the chatbot; iii) the appropriate use of user input and predefined options; iv) the setting of realistic expectations through the initial conversation; and v) the role of various other factors in technology adoption (e.g. trust).

Thirdly, the findings imply the need to investigate practically the role of universities in adopting AI in educational programmes to facilitate students' transition to the workforce.

5.3 Insights and Future Lines of Research

Drawing insights from a comprehensive literature review on AI in personal development and HRD, our exploration has yielded six major takeaways descending from the overarching themes pursued by the clusters identified with BCA. These weave together the current state and future trajectory of this interdisciplinary field, like logically linked building blocks. These blocks revolve around the aforementioned cross-fertilisation view, which does not hinder the role of AI in supporting HRD in terms of time and space by confining its action to the workplace, but rather enhances it to the point of embracing the entire employee journey, from cradle to grave, as depicted in Figure 6.

The first block, AI as a partner, not a rival, underscores the need for a collaborative and complementary relationship between humans and AI

systems. Rejecting competitive dynamics, AI should be viewed as a tool that supports and augments human capabilities, necessitating further exploration into ethical and legal guidelines for its development and use, alongside a better understanding of user perceptions and acceptance mechanisms.

Moving seamlessly to AI-enabled future skills prediction, we delve into the proactive role of AI in forecasting and identifying optimal skill sets for future workers. This involves aligning educational curricula with market demands, prompting research into collaboration between academic institutions and businesses and best practices for integrating AI into educational systems. In this view, an enhanced degree of collaboration and synergy between academic institutions and the business sector is imperative. Joint future research endeavours could indeed utilise AI systems to forecast the optimal skill set required for future workers, thereby facilitating the redesign of educational curricula.

Building on this, the third block, AI-enabled soft skills education, accentuates the significance of soft skills (e.g. communication, creativity, problem-solving, and teamwork) in the 4IR scenario. AI, serving as an enabler, assists in the assessment and improvement of these skills through interactive and personalised learning experiences. Future research is crucial to understanding users' attitudes and motivations and overcoming challenges in implementing AI for soft skills development.

The fourth block, AI in the whole employee lifecycle, builds on the outcomes of the previous ones, harvesting their fruits. In this vein, extant literature recognises the broad applicability of AI across diverse HRM processes in various sectors. Future research should delve into the optimisation of recruitment, onboarding, performance evaluation, employee training, and coaching through AI by exploring best practices and trade-offs and reaping an understanding of the impact of AI on the overall employee experience.

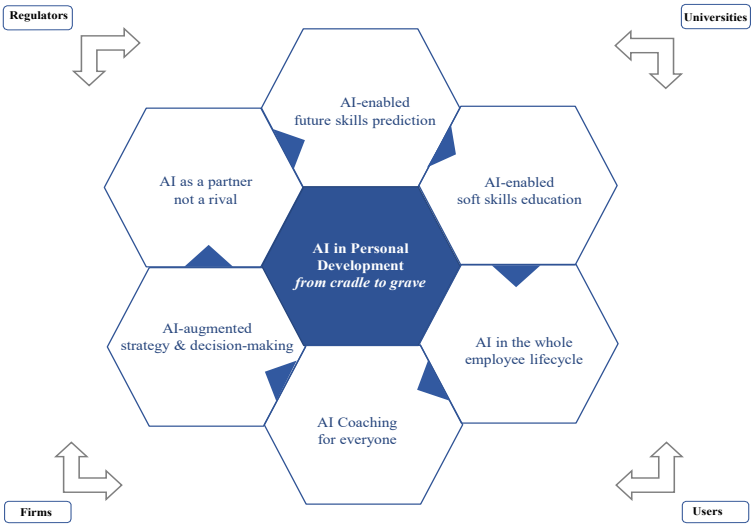
As acknowledged in the literature, business coaching is a crucial process for HRD, such that it deserves a separate block in our framework. AI Coaching for everyone unveils AI's potential to democratise and scale coaching services. By reaching a wider and more diverse audience, AI provides a secure and anonymous space for reflection and feedback, representing cost-effective solutions to support employees' psycho-physical wellbeing. Future research endeavours should empirically validate the effectiveness of such systems and delve into understanding the role of trust and other factors in the acceptance and adoption of AI Coaching.

The sixth block, AI-augmented strategy & decision-making, binds again to the first, like a Ouroboros, by addressing the strategic implications of widespread AI use in HRM and beyond. This encompasses effects on business strategy and decision-making processes, where AI informs and supports human decision-makers by providing data-driven insights, predictions, and recommendations. Future research in this domain should explore the challenges, opportunities, and best practices for integrating AI into strategic decision-making processes.

Collectively, these intertwined themes construct a comprehensive and cohesive framework, shedding light on the intricate web of AI in personal

development and HRD, including, last but not least, the actors at play (firms, users, regulators, universities), which interact at various levels with each other and with the aforementioned technology building blocks in a synergistic manner.

Fig. 6: AI in personal development - from cradle to grave



Source: Our own elaboration.

5.4 Limitations

The present review has certain limitations that should be considered.

Firstly, the scope of the study was limited to articles published in the Scopus database, which is one of the largest sources of published articles but may still exclude relevant studies that were published in other databases such as Web of Science or Google Scholar.

Secondly, the preliminary search was also limited to scientific documents written in English and excluded other languages. This may reduce the generalisability of the results. Future research may consider including other languages to provide a more comprehensive understanding of the field.

Thirdly, 39 per cent of the full sample of papers was not included by VOSviewer in the BCN network depicted in Figure 5. Because of this, and limited to the analysis of the BCA results, this paper may have provided a partial view of the landscape of the literature concerned with AI in personal and human resource development. In this regard, however, it is important to mention the safeguards put in place by the authors: first of all, the BCA is greatly strengthened by the preliminary thematic analysis (KCA) based on the keywords of the entire sample of papers (including those missing the full text and those not included in the BCN), which provided broad overarching themes that were largely reflected in and confirmed by the analysis of BCA results. Secondly, a manual cross-check

of the contributions not included in the BCN was carried out to make sure that no contribution relevant to the emerging scientific debate was missed.

References

ACEMOGLU D., RESTREPO P. (2020), "Robots and jobs: Evidence from us labor markets", *Journal of Political Economy*, vol. 128, n. 6, pp. 2188-2244.

AVIV I., BARGER A., PYATIGORSKY S. (2021), "Novel Machine Learning Approach for Automatic Employees' Soft Skills Assessment: Group Collaboration Analysis Case Study", in Nfaoui E.H. A.C. Boumhidi J., Oubenaalia Y., Azough A. (Ed). *5th International Conference on Intelligent Computing in Data Sciences, ICDS 2021*. Institute of Electrical and Electronics Engineers Inc.

BANKINS S. (2021), "The ethical use of artificial intelligence in human resource management: a decision-making framework", *Ethics and Information Technology,* vol. 23, n. 4, pp. 841-854.

BEKAR.C., CARLAW K., LIPSEY R. (2017), "General purpose technologies in theory, application and controversy: a review", *Journal of Evolutionary Economics*, vol. 28, n. 5, pp. 1005-1033.

BENNETT E.E., MCWHORTER R.R. (2022), "Dancing in the Paradox: Virtual Human Resource Development, Online Teaching, and Learning", *Advances in Developing Human Resources*, vol. 24, n. 2, pp. 99-116.

BHARGAVA A., BESTER M., BOLTON L. (2021), "Employees' Perceptions of the Implementation of Robotics, Artificial Intelligence, and Automation (RAIA) on Job Satisfaction, Job Security, and Employability", *Journal of Technology in Behavioral Science*, vol. 6, n. 1, pp. 106-113.

BORNMANN L., HAUNSCHILD R., HUG S.E. (2018), "Visualizing the context of citations referencing papers published by Eugene Garfield: A new type of keyword co-occurrence analysis", *Scientometrics*, vol. 114, n. 2, pp. 427-437.

BUDHWAR P., MALIK A., DE SILVA M.T.T., THEVISUTHAN P. (2022), "Artificial intelligence - challenges and opportunities for international HRM: a review and research agenda", *The International Journal of Human Resource Management,* vol. 33, n. 6, pp. 1065-1097.

CAPUTO F., CILLO V., CANDELO E., LIU Y. (2019), "Innovating through digital revolution: The role of soft skills and Big Data in increasing firm performance", *Management Decision,* vol. 57, n. 8, pp. 2032-2051.

CHANG X., WANG B., HUI B. (2022), "Towards an Automatic Approach for Assessing Program Competencies", *ACM International Conference Proceeding Series. Association for Computing Machinery*, p. 119-129.

CHUANG Y.C., HU S.K., LIOU J.J.H., TZENG G.H. (2020), "A data-driven madm model for personnel selection and improvement", *Technological and Economic Development of Economy,* vol. 26, n. 4, pp. 751-784.

COLOMBO E., MERCORIO F., MEZZANZANICA M. (2019), "AI meets labor market: Exploring the link between automation and skills", *Information Economics and Policy*, vol. 47, pp. 27-37.

CROSSAN M.M., APAYDIN M. (2010), "A multi-dimensional framework of organizational innovation: A systematic review of the literature", *Journal of Management Studies*, vol. 47, n. 6, pp. 1154-1191.

DA SILVA C.F.D., DE ALBUQUERQUE A.P.G., DE MELO F.J.C., CALÁBRIA F.A., DE MEDEIROS D.D. (2020), "A fuzzy approach to the strategic development of human capital in the electric sector", *Computers and Industrial Engineering,* vol. 149, p. 106787.

DE VILLIERS R. (2021), "Seven principles to ensure future-ready accounting graduates - a model for future research and practice", *Meditari Accountancy Research,* vol. 29, n. 6, pp. 1354-1380.

DONTHU N., KUMAR S., MUKHERJEE D., PANDEY N., LIM W.M. (2021), "How to conduct a bibliometric analysis: An overview and guidelines", *Journal of Business Research*, vol. 133, pp. 285-296.

ELLIS-BRUSH K. (2021), "Augmenting Coaching Practice through digital methods", *International Journal of Evidence Based Coaching and Mentoring,* n. S15, pp. 187-197.

ELSEVIER (2023), *What does "relevance" mean in scopus?* Retrieved from https://service.elsevier.com/app/answers/detail/a_id/14182/supporthub/scopus/#

EUROPEAN PARLIAMENT (2023), "AI Act: a step closer to the first rules on Artificial Intelligence" | News | European Parliament (2023). Available from: https://www.europarl.europa.eu/news/en/press-room/20230505IPR84904/ai-act-a-step-closer-to-the-first-rules-on-artificial-intelligence.

FACHRIZAL M.R., RADLIYA N.R., MANIK A. (2019), "Development of E-Recruitment as a Decision Support System for Employee Recruitment", *IOP Conference Series: Materials Science and Engineering,* vol. 662, n. 2, p. 022018.

FAN D., BRESLIN D., CALLAHAN J.L., ISZATT-WHITE M. (2022), "Advancing literature review methodology through rigour, generativity, scope and transparency", *International Journal of Management Reviews,* vol. 24, n. 2, pp. 171-180.

FARERI S., MELLUSO N., CHIARELLO F., FANTONI G. (2021), "SkillNER: Mining and mapping soft skills from any text", *Expert Systems with Applications,* vol. 184, p. 115544.

FLETCHER L. (2019), "How can personal development lead to increased engagement? The roles of meaningfulness and perceived line manager relations", *The International Journal of Human Resource Management,* vol. 30, n. 7, pp. 1203-1226.

GKINKO L., ELBANNA A. (2022), "AI Chatbots sociotechnical research: An overview and Future Directions", in Bednar P. B.A.M. Bednar P., Islind A.S., Hult H.V., Hult H.V., Nolte A., Nolte A., Rajanen M., Zaghloul F., Ravarini A. (Ed). *CEUR Workshop Proceedings.* CEUR-WS, p. 173-183.

GRASSMANN C., SCHERMULY C.C. (2021), "Coaching With Artificial Intelligence: Concepts and Capabilities", *Human Resource Development Review,* vol. 20, n. 1, pp. 106-126.

HADDAWAY N.R., PAGE M.J., PRITCHARD C.C., MCGUINNESS L.A. (2022), "PRISMA2020: An R package and Shiny app for producing PRISMA 2020-compliant flow diagrams, with interactivity for optimised digital transparency and Open Synthesis", *Campbell Systematic Reviews*, vol. 18, n. 2, p. e1230.

HÄRTING R.C., SCHMIDT S., KRUM D. (2021), "Potentials of Emotionally Sensitive Applications Using Machine Learning", in Zimmermann A., Howlett R.J., Jain L.C. (Eds). *Human Centred Intelligent Systems,* vol. 189, pp. 207-219.

IFTIKHAR A., ALAM M., AHMED R., MUSA S., SU'UD M.M. (2021), "Risk Prediction by Using Artificial Neural Network in Global Software Development", *Computational Intelligence and Neuroscience,* vol. 2021, p. 2922728.

JACKSON M.O., KANIK Z. (2019), "How Automation that Substitutes for Labor Affects Production Networks, Growth, and Income Inequality".

JATOBÁ M., SANTOS J., GUTIERRIZ I., MOSCON D., FERNANDES P.O., TEIXEIRA J.P. (2019), "Evolution of Artificial Intelligence Research in Human Resources", in Cruz-Cunha M.M. D.D. Varajao J.E., Martinho R., Rijo R., Peres E. (Ed). *Procedia Computer Science*. Elsevier B.V., p. 137-142.

JIANG Y., AKDERE M. (2021), "An operational conceptualization of human resource analytics: implications for in human resource development", *Industrial and Commercial Training*, vol. 54, n. 1, pp. 183-200.

JOHNSON E., LUCAS G., KIM P., GRATCH J. (2019), "Intelligent tutoring system for negotiation skills Training", *Lecture Notes in Computer Science* (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics), vol. 11626 LNAI, pp. 122-127.

JOHNSON W.G., SUNDERRAMAN R., BOURGEOIS A.G. (2020), "Teaching strategies in software engineering towards industry interview preparedness", in Stikkolorum D. R.E. (Ed). *ACM International Conference Proceeding Series.* Association for Computing Machinery.

JUSTICE S., MORRISON E., YORKS L. (2020), "Enacting Reflection: A New Approach to Workplace Complexities", *Advances in Developing Human Resources*, vol. 22, n. 3, pp. 320-332.

KALINOUSKAYA I.N. (2022), "Selection of training programs for textile industry personnel using artificial intelligence", in A V. (Ed). A*IP Conference Proceedings.* American Institute of Physics Inc.

KANATOURI S. (2020), *The digital coach, The Digital Coach,* Taylor and Francis Inc.

KANTOLA J., PIIRTO A., TOIVONEN J., CHANG Y., VANHARANTA H. (2011), "Target training with soft computing tools", *Journal of Computational Science,* vol. 2, n. 3, pp. 207-215.

KESSLER M.M. (1963), "Bibliographic coupling between scientific papers", *American Documentation*, vol. 14, n. 1, pp. 10-25.

KOSARAVA K. (2021), "Applying Natural Language Processing Models to Create Recommendations for Professional Skills Development", in Petrenko S.A. T.D.A. (Ed). *CEUR Workshop Proceedings*. CEUR-WS, p. 69-78.

KUHAIL M.A., ALTURKI N., ALRAMLAWI S., ALHEJORI K. (2023), "Interacting with educational chatbots: A systematic review", *Education and Information Technologies,* vol. 28, n. 1, pp. 973-1018.

LEE C.H., BRUVOLD N.T. (2003), "Creating value for employees: investment in employee development", *The International Journal of Human Resource Management*, vol. 14, n. 6, pp. 981-1000.

LEE Y.C., YAMASHITA N., HUANG Y. (2021), "Exploring the Effects of Incorporating Human Experts to Deliver Journaling Guidance through a Chatbot", *Proceedings of the ACM on Human-Computer Interaction*, vol. 5, n. CSCW1.

LEJEUNE C., BEAUSAERT S., RAEMDONCK I. (2021), "The impact on employees' job performance of exercising self-directed learning within personal development plan practice", *International Journal of Human Resource Management*, vol. 32, n. 5, pp. 1086-1112.

LI J.M., WU T.-J., WU Y.J., GOH M. (2023), "Systematic literature review of human-machine collaboration in organizations using bibliometric analysis", *Management Decision*, vol. 61, n. 10, pp. 2920-2944.

LIU R.L. (2017), "A new bibliographic coupling measure with descriptive capability", *Scientometrics*, vol. 110, n. 2, pp. 915-935.

MADDUMAGE C., SENEVIRATHNE D., GAYASHAN I., SHEHAN T., SUMATHIPALA S. (2019), "Intelligent Recruitment System", *2019 IEEE 5th International Conference for Convergence in Technology, I2CT 2019*. Institute of Electrical and Electronics Engineers Inc.

MAI V., WOLFF A., RICHERT A., PREUSSER I. (2021), "Accompanying Reflection Processes by an AI-Based StudiCoachBot: A Study on Rapport Building in Human-Machine Coaching Using Self Disclosure", *Lecture Notes in Computer Science* (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics), vol. 13096 LNCS, pp. 439-457.

MAITY S. (2019), "Identifying opportunities for artificial intelligence in the evolution of training and development practices", *Journal of Management Development*, vol. 38, n. 8, pp. 651-663.

MAKRIDAKIS S. (2017), "The forthcoming Artificial Intelligence (AI) revolution: Its impact on society and firms", *Futures*, vol. 90, pp. 46-60.

MALIK N., TRIPATHI S.N., KAR A.K., GUPTA S. (2022), "Impact of artificial intelligence on employees working in industry 4.0 led organizations", *International Journal of Manpower,* vol. 43, n. 2, pp. 334-354.

MAN M.M.K. (2020), "Human Resource Development Requirements in Industrial Revolution 4.0", in Ali Turkmenoglu M., Cicek B. (Eds). C*ontemporary Global Issues in Human Resource Management*, pp. 129-139.

MARIANI M.M., HASHEMI N., WIRTZ J. (2023), "Artificial intelligence empowered conversational agents: A systematic literature review and research agenda", *Journal of Business Research,* vol. 161, p. 113838.

MICHALOPOULOS D., KARRAS A., KARRAS C., SIOUTAS S., GIOTOPOULOS K.C. (2022), "Neuro-Fuzzy Employee Ranking System in the Public Sector", *Frontiers in Artificial Intelligence and Applications*, vol. 358, pp. 325-333.

MISHRA S.S., KUNTE M., NEELAM N., BHATTACHARYA S., MULAY P. (2021), "HR Process Automation: A Bibliometric Analysis", *Library Philosophy and Practice,* pp. 1-12.

MUKHERJEE D., LIM W.M., KUMAR S., DONTHU N. (2022), "Guidelines for advancing theory and practice through bibliometric research", *Journal of Business Research*, vol. 148, pp. 101-115.

MURALIDHAR S., SIEGFRIED R., GATICA-PEREZ D., ODOBEZ J.-M. (2018), "Facing employers and customers: What do gaze and expressions tell about soft skills?", in Abdennadher S. A.F. (Ed). A*CM International Conference Proceeding Series. Association for Computing Machinery*, p. 121-126.

NAMBIAR S.K., DAS R., RASIPURAM S., JAYAGOPI D.B. (2017), "Automatic generation of actionable feedback towards improving social competency in job interviews", in Bianchi-Berthouze N. A.P. Baud-Bovy G., Volta E., Volpe G., Gori M. (Ed). *MIE 2017 - Proceedings of the 1st ACM SIGCHI International Workshop on Multimodal Interaction for Education, Co-located with ICMI 2017.* Association for Computing Machinery, Inc, p. 53-59.

NOSRATABADI S., ZAHED R.K., PONKRATOV V.V., KOSTYRIN E.V. (2022), "Artificial Intelligence Models and Employee Lifecycle Management: A Systematic Literature Review", *Organizacija*, vol. 55, n. 3, pp. 181-198.

ODREKHIVSKYY M., PASICHNYK V., RZHEUSKYI A., ANDRUNYK V., NAZARUK M., KUNANETS O., TABACHYSHYN D. (2019), "Problems of the intelligent virtual learning environment development", in Emmerich M. V.V. Lytvyn V., Yevseyeva I., Basto-Fernandes V., Dosyn D. (Ed). *CEUR Workshop Proceedings.* CEUR-WS, p. 359-369.

PASIKOWSKA A., LAZZERI N., ZARAKI A. (2013), "A dialogue with a virtual imaginary interlocutor as a form of a psychological support for well-being", *ACM International Conference Proceeding Series.* Warsaw.

PISANI N., KOURULA A., KOLK A., MEIJER R. (2017), "How global is international CSR research? Insights and recommendations from a systematic review", *Journal of World Business*, vol. 52, n. 5, pp. 591-614.

POQUET O., DE LAAT M. (2021), "Developing capabilities: Lifelong learning in the age of AI", *British Journal of Educational Technology,* vol. 52, n. 4, pp. 1695-1708.

RADHAKRISHNAN S., ERBIS S., ISAACS J.A., KAMARTHI S. (2017), "Novel keyword co-occurrence network-based methods to foster systematic reviews of scientific literature", *PLOS ONE*, vol. 12, n. 3, p. e0172778.

RAHIMI S., KHORASANI A., REZAEIZADEH M., WATERWORTh J. (2022), "The virtual human resource development (VHRD) approach: an integrative literature review", *European Journal of Training and Development,* vol. 46, n. 5-6, pp. 484-503.

RASIPURAM S., JAYAGOPI D.B. (2020), "Automatic multimodal assessment of soft skills in social interactions: a review", *Multimedia Tools and Applications,* vol. 79, n. 19-20, pp. 13037-13060.

RAVID D.M., TOMCZAK D.L., WHITE J.C., BEHREND T.S. (2020), "EPM 20/20: A Review, Framework, and Research Agenda for Electronic Performance Monitoring", *Journal of Management,* vol. 46, n. 1, pp. 100-126.

RAY D., MOOKHERJEE D. (2022), "Growth, automation, and the long-run share of labor", *Review of Economic Dynamics*, vol. 46, pp. 1-26.

RODRIGUEZ-RUIZ J., ALVAREZ-DELGADO A., CARATOZZOLO P. (2021), "Use of Natural Language Processing (NLP) Tools to Assess Digital Literacy Skills", *Future of Educational Innovation Workshop Series - Machine Learning-Driven Digital Technologies for Educational Innovation Workshop 2021.* Institute of Electrical and Electronics Engineers Inc.

SALVETTI F., BERTAGNI B., NEGRI F., BERSANELLI M., USAI R., MILANI A., DE ROSA D. (2022), "At Your Best! Artificial Intelligence, People and Business Analytics, Highly Realistic Avatars, Innovative Learning and Development", *Lecture Notes in Networks and Systems,* vol. 349 LNNS, pp. 280-289.

SAYFULLINA L., MALMI E., KANNALA J. (2018), "Learning representations for soft skill matching", L*ecture Notes in Computer Science* (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics), vol. 11179 LNCS, pp. 141-152.

SCHERMULY C.C., GRASSMANN C., ACKERMANN S., WEGENER R. (2022), "The future of workplace coaching-an explorative Delphi study", *Coaching*, vol. 15, n. 2, pp. 244-263.

SCHUTT S., HOLLOWAY D., LINEGAR D., DEMAN D. (2017), "Using simulated digital role plays to teach healthcare "soft skills"", in Rodrigues N. D.D. Vilaca J.L., Dias N., Wong K., de Freitas S. (Ed). *2017 IEEE 5th International Conference on Serious Games and Applications for Health,* SeGAH 2017. Institute of Electrical and Electronics Engineers Inc.

SIHOMBING O., HANOSO G.R., LAIA Y., MAULANA H., TAMBA S.P., NABABAN M.N.K., INDRA E., BATUBARA M.D., ZENDRATO N. (2019), "Determining Outstanding Employee Using Simple Multi-Attribute Rating Technique Method", *Journal of Physics: Conference Series*, vol. 1230, n. 1, p. 012076.

SIMA V., GHEORGHE I.G., SUBIĆ J., NANCU D. (2020), "Influences of the industry 4.0 revolution on the human capital development and consumer behavior: A systematic review", *Sustainability* (Switzerland), vol. 12, n. 10.

SIVATHANU B., PILLAI R. (2018), "Smart HR 4.0 - how industry 4.0 is disrupting HR", *Human Resource Management International Digest,* vol. 26, n. 4, pp. 7-11.

SOLICHIN A., SAPUTRI F.H. (2021), "An Adaptive Neuro-Fuzzy Inference System (ANFIS) Method for Recommending Employee Mutations in a Manufacturing Company", *Journal of Physics: Conference Series*, vol. 1908, n. 1, p. 012016.

STACHOVÁ K., PAPULA J., STACHO Z., KOHNOVÁ L. (2019), "External partnerships in employee education and development as the key to facing industry 4.0 challenges", *Sustainability* (Switzerland), vol. 11, n. 2.

STONE D.L., DEADRICK D.L., LUKASZEWSKI K.M., JOHNSON R. (2015), "The influence of technology on the future of human resource management", *Human Resource Management Review,* vol. 25, n. 2, pp. 216-231.

STROHMEIER S., PIAZZA F. (2015), "Artificial Intelligence Techniques in Human Resource Management-A Conceptual Exploration", in Kahraman C., Çevik Onar S. (Eds). *Intelligent Techniques in Engineering Management: Theory and Applications,* pp. 149-172.

SWANSON R.A. (1995), "Human resource development: Performance is the key", *Human Resource Development Quarterly,* vol. 6, n. 2, pp. 207-213.

TERBLANCHE N. (2020), "A design framework to create artificial intelligence coaches", *International Journal of Evidence Based Coaching and Mentoring,* vol. 18, n. 2, pp. 152-165.

TERBLANCHE N., KIDD M. (2022), "Adoption Factors and Moderating Effects of Age and Gender That Influence the Intention to Use a Non-Directive Reflective Coaching Chatbot", *SAGE Open*, vol. 12, n. 2.

TERBLANCHE N., MOLYN J., DE HAAN E., NILSSON V.O. (2022a), "Coaching at Scale: Investigating the Efficacy of Artificial Intelligence Coaching", *International Journal of Evidence Based Coaching and Mentoring*, vol. 20, n. 2, pp. 20-36.

TERBLANCHE N., MOLYN J., HAAN E. DE, NILSSON V.O. (2022b), "Comparing artificial intelligence and human coaching goal attainment efficacy", *PLOS ONE*, vol. 17, n. 6, p. e0270255.

TERBLANCHE N., MOLYN J., WILLIAMS K., MARITZ J. (2023), "Performance matters: students' perceptions of Artificial Intelligence Coach adoption factors", *Coaching: An International Journal of Theory, Research and Practice,* vol. 16, n. 1, pp. 100-114.

TRANFIELD D., DENYER D., SMART P. (2003), "Towards a Methodology for Developing Evidence-Informed Management Knowledge by Means of Systematic Review", *British Journal of Management,* vol. 14, n. 3, pp. 207-222.

VAN ECK, N.J., WALTMAN, L. (2010), "Software survey: VOSviewer, a computer program for bibliometric mapping", *Scientometrics*, vol. 84, n.2, pp. 523-538

VAN OORSCHOT J.A.W.H., HOFMAN E., HALMAN J.I.M. (2018), "A bibliometric review of the innovation adoption literature", *Technological Forecasting and Social Chang*e, vol. 134, pp. 1-21.

VOTTO A.M., VALECHA R., NAJAFIRAD P., RAO H.R. (2021), "Artificial Intelligence in Tactical Human Resource Management: A Systematic Literature Review", *International Journal of Information Management Data Insights,* vol. 1, n. 2, p. 100047.

VRONTIS D., CHRISTOFI M., PEREIRA V., TARBA S., MAKRIDES A., TRICHINA E. (2022), "Artificial intelligence, robotics, advanced technologies and human resource management: a systematic review", *The International Journal of Human Resource Management,* vol. 33, n. 6, pp. 1237-1266.

VYSOTSKAYA P., ZABELINA S., KULESHOVA J., PINCHUK I. (2020), "Using the capabilities of artificial intelligence in the development of reflection skills", in Rudoy D.K.V. Olshevskaya A. (Ed). *E3S Web of Conferences*. EDP Sciences.

WALTMAN, L., VAN ECK, N. J., NOYONS, E. C. M. (2010), "A unified approach to mapping and clustering of bibliometric networks", *Journal of Informetrics,* vol. 4, n.4, pp. 629-635.

WEINBERG B.H. (1974), "Bibliographic coupling: A review", *Information Storage and Retrieval*, vol. 10, n. 5-6, pp. 189-196.

WHYSALL Z., OWTRAM M., BRITTAIN S. (2019), "The new talent management challenges of Industry 4.0", *Journal of Management Development*, vol. 38, n. 2, pp. 118-129.

WIJAYATI D.T., RAHMAN Z., FAHRULLAH A., RAHMAN M.F.W., ARIFAH I.D.C., KAUTSAR A. (2022), "A study of artificial intelligence on employee performance and work engagement: the moderating role of change leadership", *International Journal of Manpower,* vol. 43, n. 2, pp. 486-512.

WILLIAMS P. (2019), "Does competency-based education with blockchain signal a new mission for universities?", *Journal of Higher Education Policy and Management,* vol. 41, n. 1, pp. 104-117.

WILLIAMSON B., PYKETT J., NEMORIN S. (2018), "Biosocial spaces and neurocomputational governance: brain-based and brain-targeted technologies in education", *Discourse*, vol. 39, n. 2, pp. 258-275.

WINGS I., NANDA R., ADEBAYO K.J. (2021), "A Context-Aware Approach for Extracting Hard and Soft Skills", in Klimova A. B.A. Bilas A., Harmandaris V., Kalligiannaki E., Kanellou E. (Ed). *Procedia Computer Science*. Elsevier B.V., p. 163-172.

WIRTZ B.W., MÜLLER W.M. (2019), "An integrated artificial intelligence framework for public management", *Public Management Review,* vol. 21, n. 7, pp. 1076-1100.

WOHLIN C. (2014), "Guidelines for snowballing in systematic literature studies and a replication in software engineering", *Proceedings of the 18th International Conference on Evaluation and Assessment in Software Engineering - EASE '14.* Presented at the 18th International Conference, ACM Press, London, England, United Kingdom, p. 1-10.

WOLLNY S., SCHNEIDER J., DI MITRI D., WEIDLICH J., RITTBERGER M., DRACHSLER H. (2021), "Are We There Yet? - A Systematic Literature Review on Chatbots in Education", *Frontiers in Artificial Intelligence,* vol. 4.

XIN O.K., WIDER W., LING L.K. (2022), "Human Resource Artificial Intelligence Implementation and Organizational Performance in Malaysia", *Asia-Pacific Social Science Review,* vol. 22, n. 3, pp. 18-37.

YORKS L., ROTATORI D., SUNG S., JUSTICE S. (2020), "Workplace Reflection in the Age of AI: Materiality, Technology, and Machines", *Advances in Developing Human Resources,* vol. 22, n. 3, pp. 308-319.

ZEL S., KONGAR E. (2020), "Transforming Digital Employee Experience with Artificial Intelligence", *2020 IEEE / ITU International Conference on Artificial Intelligence for Good, AI4G 2020*. Institute of Electrical and Electronics Engineers Inc., p. 176-179.

ZHOU L., WU Q., CHEN H. (2022), "Multifactor Evaluation Approach for Human Performance", *Arabian Journal for Science and Engineering,* vol. 47, n. 3, pp. 3763-3772.

ZORRILLA A.L., TORRES M.I. (2022), "A Multilingual Neural Coaching Model with Enhanced Long-term Dialogue Structure", *ACM Transactions on Interactive Intelligent Systems,* vol. 12, n. 2, p. 16:1-16:47.

ZUPIC I., ČATER T. (2015), "Bibliometric Methods in Management and Organization", *Organizational Research Methods,* vol. 18, n. 3, pp. 429-472.

Academic or professional positions and contacts

Francesco Laviola
PhD Candidate in Business Management
Sapienza University of Rome - Italy
e-mail: francesco.laviola@uniroma1.it

Nicola Cucari
Assistant Professor of Management
Sapienza University of Rome - Italy
e-mail: nicola.cucari@uniroma1.it

Harry Novic
CEO and Founder - Rocky.ai.
e-mail: harry@rocky.ai

sinergie
italian journal of management

ISSN 0393-5108
ISSN 2785-549X
DOI 10.7433/s123.2024.06
pp. 121-163

FONDAZIONE CUEIM

S I
M A
Italian Society of
MANAGEMENT

Authors	Title	Year	Source title	DOI	Link
Kambur E., Yildirim T.	From traditional to smart human resources management	2023	International Journal of Manpower	10.1108/IJM-10-2021-0622	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85138364523&doi=10.1108%2fIJM-10-2021-0622&partnerID=40&md5=64c087a3251ee21a7c17c7dfde8ac96b
Pikkarainen A., Tihinen M.	Education as a Promoter of Digital Transformation in the Manufacturing Industry	2023	Lecture Notes in Networks and Systems	10.1007/978-3-031-16598-6_8	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85142417247&doi=10.1007%2f978-3-031-16598-6_8&partnerID=40&md5=8330daef6e8bd11d7790d582e5efce65
Cranefield J., Winikoff M., Chiu Y.-T., Li Y., Doyle C., Richter A.	Partnering with AI: the case of digital productivity assistants	2023	Journal of the Royal Society of New Zealand	10.1080/03036758.2022.2114507	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85137781630&doi=10.1080%2f03036758.2022.2114507&partnerID=40&md5=5a8f1addd3018f6cd73eb0cdfa28134d
Kuhail M.A., Alturki N., Alramlawi S., Alhejori K.	Interacting with educational chatbots: A systematic review	2023	Education and Information Technologies	10.1007/s10639-022-11177-3	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85133654787&doi=10.1007%2fs10639-022-11177-3&partnerID=40&md5=e3da4574f066140091284d69e10fc14fb
Terblanche N., Molyn J., Williams K., Maritz J.	Performance matters: students' perceptions of Artificial Intelligence Coach adoption factors	2023	Coaching	10.1080/17521882.2022.2094278	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85133237360&doi=10.1080%2f17521882.2022.2094278&partnerID=40&md5=cd365ad8e498a1e4c474b891ba26581f
Dutta D., Mishra S.K., Tyagi D.	Augmented employee voice and employee engagement using artificial intelligence-enabled chatbots: a field study	2023	International Journal of Human Resource Management	10.1080/09585192.2022.2085525	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85132195872&doi=10.1080%2f09585192.2022.2085525&partnerID=40&md5=2e34b7af1ad0e06315b55a8f8790b181
Lee J.	The era of Omni-learning: Frameworks and practices of the expanded human resource development	2023	Organizational Dynamics	10.1016/j.orgdyn.2022.100916	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85131447800&doi=10.1016%2fj.orgdyn.2022.100916&partnerID=40&md5=0b5c162d8f5259d46b08dfbcec8d06c8
Tuomi I.	Artificial intelligence, 21st century competences, and socio-emotional learning in education: More than high-risk?	2022	European Journal of Education	10.1111/ejed.12531	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85139454507&doi=10.1111%2fejed.12531&partnerID=40&md5=9eb985e853a1b5001bd41b15be16f211
Michalopoulos D., Karras A., Karras C., Sioutas S., Giotopoulos K.C.	Neuro-Fuzzy Employee Ranking System in the Public Sector	2022	Frontiers in Artificial Intelligence and Applications	10.3233/FAIA220399	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85142152732&doi=10.3233%2fFAIA220399&partnerID=40&md5=e8d206b42b6e01c13a24f99b43564da1
Xin O.K., Wider W., Ling L.K.	Human Resource Artificial Intelligence Implementation and Organizational Performance in Malaysia	2022	Asia-Pacific Social Science Review		https://www.scopus.com/inward/record.uri?eid=2-s2.0-85139512697&partnerID=40&md5=e51011e311e6f1c246322c1ae54b08fb
Bottrill C.	Human capital futures: an educational perspective	2022	Journal of Tourism Futures	10.1108/JTF-04-2021-0101	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85132642029&doi=10.1108%2fJTF-04-2021-0101&partnerID=40&md5=f979967e48a8789879643ec88a8131ca
Nosratabadi S., Zahed R.K., Ponkratov V.V., Kostyrin E.V.	Artificial Intelligence Models and Employee Lifecycle Management: A Systematic Literature Review	2022	Organizacija	10.2478/orga-2022-0012	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85139251324&doi=10.2478%2forga-2022-0012&partnerID=40&md5=dc18dfde9751ee2e4da89772d6f194aaa
Weimann T.G., Schlieter H., Brendel A.B.	Virtual Coaches: Background, Theories, and Future Research Directions	2022	Business and Information Systems Engineering	10.1007/s12599-022-00757-9	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85134289784&doi=10.1007%2fs12599-022-00757-9&partnerID=40&md5=82efbe715f7c0c7fe0c1eca224827f24
Zorrilla A.L., Torres M.I.	A Multilingual Neural Coaching Model with Enhanced Long-term Dialogue Structure	2022	ACM Transactions on Interactive Intelligent Systems	10.1145/3487066	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85135059657&doi=10.1145%2f3487066&partnerID=40&md5=12d79efc0c9ecb21b85253705dc3a7a0
Terblanche N., Molyn J., de Haan E., Nilsson V.O.	Comparing artificial intelligence and human coaching goal attainment efficacy	2022	PLoS ONE	10.1371/journal.pone.0270255	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85132256014&doi=10.1371%2fjournal.pone.0270255&partnerID=40&md5=a19a5964f5a62cae047cc47adadf5a1d
Rahimi S., Khorasani A., Rezaeizadeh M., Waterworth J.	The virtual human resource development (VHRD) approach: an integrative literature review	2022	European Journal of Training and Development	10.1108/EJTD-08-2020-0131	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85107480295&doi=10.1108%2fEJTD-08-2020-0131&partnerID=40&md5=34563c8c6e7f3585e9cb1ef5bbae6fbd
Wijayati D.T., Rahman Z., Fahrullah A., Rahman M.F.W., Arifah I.D.C., Kautsar A.	A study of artificial intelligence on employee performance and work engagement: the moderating role of change leadership	2022	International Journal of Manpower	10.1108/IJM-07-2021-0423	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85122196278&doi=10.1108%2fIJM-07-2021-0423&partnerID=40&md5=f9b53898867764ed003040d61eeaae4b
Malik N., Tripathi S.N., Kar A.K., Gupta S.	Impact of artificial intelligence on employees working in industry 4.0 led organizations	2022	International Journal of Manpower	10.1108/IJM-03-2021-0173	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85108141046&doi=10.1108%2fIJM-03-2021-0173&partnerID=40&md5=5c782f7ceb83b1b0825869106d3573e4
Josten C., Lordan G.	Automation and the changing nature of work	2022	PLoS ONE	10.1371/journal.pone.0266326	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85129455346&doi=10.1371%2fjournal.pone.0266326&partnerID=40&md5=5258219d1d673735792b1a44e099519e

sinergie
italian journal of management
Vol. 42, Issue 1, 2024

Bennett E.E., McWhorter R.R.	Dancing in the Paradox: Virtual Human Resource Development, Online Teaching, and Learning	2022	Advances in Developing Human Resources	10.1177/15234223221079440	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85127337847&doi=10.1177%2f15234223221079440&partnerID=40&md5=e33719d104d4854fc5ab2d8703fe0bea
Ardichvili A.	The Impact of Artificial Intelligence on Expertise Development: Implications for HRD	2022	Advances in Developing Human Resources	10.1177/15234223221077304	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85127221165&doi=10.1177%2f15234223221077304&partnerID=40&md5=e3da312e04f656837d443e2c2457e034
Prikshat V., Patel P., Varma A., Ishizaka A.	A multi-stakeholder ethical framework for AI-augmented HRM	2022	International Journal of Manpower	10.1108/IJM-03-2021-0118	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85122895204&doi=10.1108%2fIJM-03-2021-0118&partnerID=40&md5=f44f16752cf0aaa99d783d3bd66240b3
Kambur E., Akar C.	Human resource developments with the touch of artificial intelligence: a scale development study	2022	International Journal of Manpower	10.1108/IJM-04-2021-0216	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85119656415&doi=10.1108%2fIJM-04-2021-0216&partnerID=40&md5=f58c0641a0becbd5fe996af2107356e9
Terblanche N., Kidd M.	Adoption Factors and Moderating Effects of Age and Gender That Influence the Intention to Use a Non-Directive Reflective Coaching Chatbot	2022	SAGE Open	10.1177/21582440221096136	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85130235914&doi=10.1177%2f21582440221096136&partnerID=40&md5=956c6d9bf76968a89c8f397352a15b26
Chang X., Wang B., Hui B.	Towards an Automatic Approach for Assessing Program Competencies	2022	ACM International Conference Proceeding Series	10.1145/3506860.3506875	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85126201929&doi=10.1145%2f3506860.3506875&partnerID=40&md5=ed6ff1973c0da6935cdee4a5a7b9c323
Zhou L., Wu Q., Chen H.	Multifactor Evaluation Approach for Human Performance	2022	Arabian Journal for Science and Engineering	10.1007/s13369-021-06091-8	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85114021254&doi=10.1007%2fs13369-021-06091-8&partnerID=40&md5=17083a51bdb816140443c1f0620a3355
Arfaee M., Bahari A., Khalilzadeh M.	A novel prediction model for educational planning of human resources with data mining approach: a national tax administration case study	2022	Education and Information Technologies	10.1007/s10639-021-10699-6	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85112382934&doi=10.1007%2fs10639-021-10699-6&partnerID=40&md5=318a2c3e2ae13636c0a9451a4dc050e3
Kuteyi D., Winkler H.	Logistics Challenges in Sub-Saharan Africa and Opportunities for Digitalization	2022	Sustainability (Switzerland)	10.3390/su14042399	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85125083394&doi=10.3390%2fsu14042399&partnerID=40&md5=edf5b25005ffe004c0c48d59dfade401
Kalinouskaya I.N.	Selection of training programs for textile industry personnel using artificial intelligence	2022	AIP Conference Proceedings	10.1063/5.0077212	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85125593188&doi=10.1063%2f5.0077212&partnerID=40&md5=7894a616fee68b590c3969b3d04ee710
Chuang S.	Indispensable skills for human employees in the age of robots and AI	2022	European Journal of Training and Development	10.1108/EJTD-06-2022-0062	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85141982711&doi=10.1108%2fEJTD-06-2022-0062&partnerID=40&md5=7e1bcb1c771c49c090daf36d3a14c688
Pendyala V.S., Atrey N., Aggarwal T., Goyal S.	Enhanced Algorithmic Job Matching based on a Comprehensive Candidate Profile using NLP and Machine Learning	2022	Proceedings - IEEE 8th International Conference on Big Data Computing Service and Applications, BigDataService 2022	10.1109/BigDataService55688.2022.00040	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85141048281&doi=10.1109%2fBigDataService55688.2022.00040&partnerID=40&md5=e78e85c1dbe2e49b051fed6afda6d01b
Gold J., Jolliffe P., Stewart J., Glaister C., Halliday S.	Futures and foresight learning in HRD	2022	European Journal of Training and Development	10.1108/EJTD-05-2022-0059	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85140389379&doi=10.1108%2fEJTD-05-2022-0059&partnerID=40&md5=e4259d4811901bc2aad42ad28700c707
Gkinko L., Elbanna A.	AI Chatbots sociotechnical research: An overview and Future Directions	2022	CEUR Workshop Proceedings		https://www.scopus.com/inward/record.uri?eid=2-s2.0-85139830706&partnerID=40&md5=8e020ddb8c02968fbe94e3811440ff26
Fang R., Fang Z.	Analysis of Human Resource Allocation Scheme for Digital Media Big Data Based on Recurrent Neural Network Model	2022	Journal of Sensors	10.1155/2022/3430933	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85139789201&doi=10.1155%2f2022%2f3430933&partnerID=40&md5=255fd78d154ec5521d49aa7f22d7f52e
Rachana T.V., Vishwas H.N., Nair P.C.	HR based Chatbot using Deep Neural Network	2022	5th International Conference on Inventive Computation Technologies, ICICT 2022 - Proceedings	10.1109/ICICT54344.2022.9850474	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85137315438&doi=10.1109%2fICICT54344.2022.9850474&partnerID=40&md5=adb5c1956cc4f9778955869c8a4ec522
Shih J.-Y., Cheng T.-I.	Feasibility Study of Applying Character-Based Recurrent Neural Networks in Training Marketing Personnel	2022	5th IEEE Eurasian Conference on Educational Innovation 2022, ECEI 2022	10.1109/ECEI53102.2022.9829499	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85136143844&doi=10.1109%2fECEI53102.2022.9829499&partnerID=40&md5=363af3248b40af776ed2c5c430abc8f3
Nayak S., Kumar S., Agarwal D., Parikh P.	AI-Enabled Personalized Interview Coach in Rural India	2022	Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)	10.1007/978-3-031-11647-6_15	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85135951916&doi=10.1007%2f978-3-031-11647-6_15&partnerID=40&md5=0e25b5e9a200fd74aca66afe978ca4a5
Terblanche N., Molyn J., De Haan E., Nilsson V.O.	Coaching at Scale: Investigating theEfficacy of Artificial Intelligence Coaching	2022	International Journal of Evidence Based Coaching and Mentoring	10.24384/5cgf-ab69	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85135578933&doi=10.24384%2f5cgf-ab69&partnerID=40&md5=1ecb98d1e1492a694ce1849392 68e352
Biswas A., Chakraborty S., Deb D., Chatterjee R.	HRPro: A Machine Learning Approach for Recruitment Process Automation	2022	Lecture Notes on Data Engineering and Communications Technologies	10.1007/978-981-19-2347-0_58	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85135539527&doi=10.1007%2f978-981-19-2347-0_58&partnerID=40&md5=fafee7e43b2b4256b233be2b1f954b64

Morozevich E.S., Korotkikh V.S., Kuznetsova Y.A.	The development of a model for a personalized learning path using machine learning methods	2022	Business Informatics	10.17323/2587-814X.2022.2.21.35	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85135246349&doi=10.17323%2f2587-814X.2022.2.21.35&partnerID=40&md5=6fbf069da83f2695a6407eb315b360d0
Saengrith W., Viriyavejakul C., Pimdee P.	Problem-Based Blended Training via Chatbot to Enhance the Problem-Solving Skill in the Workplace	2022	Emerging Science Journal	10.28991/ESJ-2022-SIED-01	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85135150112&doi=10.28991%2fESJ-2022-SIED-01&partnerID=40&md5=edbf7355cee6cb92599d20290077fff8
Pande C., Fill H.-G., Hinkelmann K.	A Computational Literature Analysis of Conversational AI Research with a Focus on the Coaching Domain	2022	EPiC Series in Computing	10.29007/lh9r	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85133733678&doi=10.29007%2flh9r&partnerID=40&md5=e5b3af200fb2b6e9a1a39b01e8db1fdd
Abril-Jimenez P., Cabrera-Umpierrez M.F., Gonzalez S., Carreton R., Claassen G., Arredondo Waldmeyer M.T.	Design of Human-Centered Adaptive Support Tools to Improve Workability in Older Workers. A Field of Research of Human-Centered AI	2022	Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)	10.1007/978-3-031-05028-2_11	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85133001578&doi=10.1007%2f978-3-031-05028-2_11&partnerID=40&md5=7d0795ed35f2b7f419a13599f02bf0c2
Lu X.	A Human Resource Demand Forecasting Method Based on Improved BP Algorithm	2022	Computational Intelligence and Neuroscience	10.1155/2022/3534840	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85128468247&doi=10.1155%2f2022%2f3534840&partnerID=40&md5=3b79982ff6bcfa314a21a6b522b5a05b
Henderikx M., Stoffers J.	An Exploratory Literature Study into Digital Transformation and Leadership: Toward Future-Proof Middle Managers	2022	Sustainability (Switzerland)	10.3390/su14020687	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85122465704&doi=10.3390%2fsu14020687&partnerID=40&md5=4720c93d93ed5fff34cf9d8060e73da7
Ham H., Kim E., Cho D.	The Organization's Sustainable Work Stress and Maladjustment Management Plan by Predicting Early Retirement through Big Data Analysis: Focused on the Case of South Korea	2022	Sustainability (Switzerland)	10.3390/su14010434	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85122108321&doi=10.3390%2fsu14010434&partnerID=40&md5=74a61e6d49dcff87a01fa1a0a8de8ac5
Schermuly C.C., Graßmann C., Ackermann S., Wegener R.	The future of workplace coaching–an explorative Delphi study	2022	Coaching	10.1080/17521882.2021.2014542	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85121372367&doi=10.1080%2f17521882.2021.2014542&partnerID=40&md5=c84d58115cbec55222c7c3edba365644
Belchik T.A.	Artificial Intelligence as a Factor in Labor Productivity	2022	Lecture Notes in Networks and Systems	10.1007/978-3-030-77000-6_62	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85120886409&doi=10.1007%2f978-3-030-77000-6_62&partnerID=40&md5=6a8cf42a412117afb4d2b517825821f0
Salvetti F., Bertagni B., Negri F., Bersanelli M., Usai R., Milani A., De Rosa D.	At Your Best! Artificial Intelligence, People and Business Analytics, Highly Realistic Avatars, Innovative Learning and Development	2022	Lecture Notes in Networks and Systems	10.1007/978-3-030-90677-1_27	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85119858996&doi=10.1007%2f978-3-030-90677-1_27&partnerID=40&md5=b529d3368e123ffeee764c176226fd0d
Singh A., Shaurya A.	Impact of Artificial Intelligence on HR practices in the UAE	2021	Humanities and Social Sciences Communications	10.1057/s41599-021-00995-4	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85120893150&doi=10.1057%2fs41599-021-00995-4&partnerID=40&md5=bb16905cb9465bbf8070f9335a66f773
Bankins S.	The ethical use of artificial intelligence in human resource management: a decision-making framework	2021	Ethics and Information Technology	10.1007/s10676-021-09619-6	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85119871079&doi=10.1007%2fs10676-021-09619-6&partnerID=40&md5=9b3b0abfa0ca58758c187e6f4eee164c
Fareri S., Melluso N., Chiarello F., Fantoni G.	SkillNER: Mining and mapping soft skills from any text	2021	Expert Systems with Applications	10.1016/j.eswa.2021.115544	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85109427719&doi=10.1016%2fj.eswa.2021.115544&partnerID=40&md5=e6804a8adabb860d3011b7d9d350ba83
De Villiers R.	Seven principles to ensure future-ready accounting graduates – a model for future research and practice	2021	Meditari Accountancy Research	10.1108/MEDAR-04-2020-0867	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85093927978&doi=10.1108%2fMEDAR-04-2020-0867&partnerID=40&md5=28b0be88320d87ec88e8cdaac1b15583
Votto A.M., Valecha R., Najafirad P., Rao H.R.	Artificial Intelligence in Tactical Human Resource Management: A Systematic Literature Review	2021	International Journal of Information Management Data Insights	10.1016/j.jjimei.2021.100047	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85126609601&doi=10.1016%2fj.jjimei.2021.100047&partnerID=40&md5=581f5d129e8500234f31731e7a56671f
Heo S., Han S., Shin Y., Na S.	Challenges of data refining process during the artificial intelligence development projects in the architecture, engineering and construction industry	2021	Applied Sciences (Switzerland)	10.3390/app112210919	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85119882468&doi=10.3390%2fapp112210919&partnerID=40&md5=1cb7a674a22c3ab001de5ad80a3df423
Silva D.L., De Jesus K.L.M., Villaverde B.S., Adina E.M.	Management competency model: Predictive neural network approach for empirical components of construction project proficiency	2021	Frontiers in Artificial Intelligence and Applications	10.3233/FAIA210257	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85120462197&doi=10.3233%2fFAIA210257&partnerID=40&md5=07ecb4d2e8fda41feb7d78affbb17016
Song Y., Zhao X., Jiang D., Huang X., Zhao W., Xu Q., Wong R.C.-W., Yang Q.	SmartSales: An AI-Powered Telemarketing Coaching System in FinTech	2021	MM 2021 - Proceedings of the 29th ACM International Conference on Multimedia	10.1145/3474085.3478555	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85119380298&doi=10.1145%2f3474085.3478555&partnerID=40&md5=e029493de06708825caf7ea6d2ec5e7b
Wollny S., Schneider J., Di Mitri D., Weidlich J., Rittberger M., Drachsler H.	Are We There Yet? - A Systematic Literature Review on Chatbots in Education	2021	Frontiers in Artificial Intelligence	10.3389/frai.2021.654924	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85117956743&doi=10.3389%2ffrai.2021.654924&partnerID=40&md5=40becb801e398f23b0c51080fa4fecc6
Solichin A., Hana Saputri F.	An Adaptive Neuro-Fuzzy Inference System (ANFIS) Method for Recommending Employee Mutations in a Manufacturing Company	2021	Journal of Physics: Conference Series	10.1088/1742-6596/1908/1/012016	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85111120388&doi=10.1088%2f1742-6596%2f1908%2f1%2f012016&partnerID=40&md5=77c9694603703fdc30df162435d172dc
Poquet O., de Laat M.	Developing capabilities: Lifelong learning in the age of AI	2021	British Journal of Educational Technology	10.1111/bjet.13123	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85105779331&doi=10.1111%2fbjet.13123&partnerID=40&md5=9b7829407d32abf78f8df023b8e04ff6

Lee Y.-C., Yamashita N., Huang Y.	Exploring the Effects of Incorporating Human Experts to Deliver Journaling Guidance through a Chatbot	2021	Proceedings of the ACM on Human-Computer Interaction	10.1145/3449196	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85130295463&doi=10.1145%2f3449196&partnerID=40&md5=1604ee5c0785af345bea437939426094
Balog M.M., Demidova S.E.	Human Capital Development in the Context of the Fourth Industrial Revolution	2021	IOP Conference Series: Earth and Environmental Science	10.1088/1755-1315/666/6/062120	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85102772395&doi=10.1088%2f1755-1315%2f666%2f6%2f062120&partnerID=40&md5=24b9436cbd17b5bb15324116f3428f17
Bhargava A., Bester M., Bolton L.	Employees' Perceptions of the Implementation of Robotics, Artificial Intelligence, and Automation (RAIA) on Job Satisfaction, Job Security, and Employability	2021	Journal of Technology in Behavioral Science	10.1007/s41347-020-00153-8	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85139769247&doi=10.1007%2fs41347-020-00153-8&partnerID=40&md5=5c52e3132fa88f98f0773a5490c29c31
Graßmann C., Schermuly C.C.	Coaching With Artificial Intelligence: Concepts and Capabilities	2021	Human Resource Development Review	10.1177/1534484320982891	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85098008845&doi=10.1177%2f1534484320982891&partnerID=40&md5=0c4f8c5a5be95b357f5a0959bd135147
Kulikov S.B., Shirokova A.V.	Artificial intelligence, culture and education	2021	AI and Society	10.1007/s00146-020-01026-7	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85088830624&doi=10.1007%2fs00146-020-01026-7&partnerID=40&md5=6e059329c242c82daa600bf71ad28066
Rodriguez-Ruiz J., Alvarez-Delgado A., Caratozzolo P.	Use of Natural Language Processing (NLP) Tools to Assess Digital Literacy Skills	2021	Future of Educational Innovation Workshop Series - Machine Learning-Driven Digital Technologies for Educational Innovation Workshop 2021	10.1109/IEEECONF53024.2021.9733779	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85128434563&doi=10.1109%2fIEEECONF53024.2021.9733779&partnerID=40&md5=0d08dba2d39c896eaa78506bf35ddd3d
Aviv I., Barger A., Pyatigorsky S.	Novel Machine Learning Approach for Automatic Employees' Soft Skills Assessment: Group Collaboration Analysis Case Study	2021	5th International Conference on Intelligent Computing in Data Sciences, ICDS 2021	10.1109/ICDS53782.2021.9626760	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85123462691&doi=10.1109%2fICDS53782.2021.9626760&partnerID=40&md5=72b3f33ea75e2f231d4bcd1235a40cb1
Kosarava K.	Applying Natural Language Processing Models to Create Recommendations for Professional Skills Development	2021	CEUR Workshop Proceedings		https://www.scopus.com/inward/record.uri?eid=2-s2.0-85122827198&partnerID=40&md5=37acc2fef18aaedd2b3012a367817be4
Zhao B., Xu Y., Cheng J.	Evaluation and Image Analysis of Enterprise Human Resource Management Based on the Simulated Annealing-Optimized BP Neural Network	2021	Computational Intelligence and Neuroscience	10.1155/2021/3133065	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85121991027&doi=10.1155%2f2021%2f3133065&partnerID=40&md5=205843a91bd1272e18f39d3abe8fba20
Jiang Y., Akdere M.	An operational conceptualization of human resource analytics: implications for in human resource development	2021	Industrial and Commercial Training	10.1108/ICT-04-2021-0028	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85121315722&doi=10.1108%2fICT-04-2021-0028&partnerID=40&md5=c34ce3b2e66bc63811815a05df4b31c2
Wings I., Nanda R., Adebayo K.J.	A Context-Aware Approach for Extracting Hard and Soft Skills	2021	Procedia Computer Science	10.1016/j.procs.2021.10.016	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85120572932&doi=10.1016%2fj.procs.2021.10.016&partnerID=40&md5=9d0404fbea6d1a90400005bb0c9f553c
Mai V., Wolff A., Richert A., Preusser I.	Accompanying Reflection Processes by an AI-Based StudiCoachBot: A Study on Rapport Building in Human-Machine Coaching Using Self Disclosure	2021	Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)	10.1007/978-3-030-90328-2_29	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85119879119&doi=10.1007%2f978-3-030-90328-2_29&partnerID=40&md5=1e12261eca9358a7d0ab9f3f01aa953c
Haefner F., Härting R.-C., Bueechl J.	Potentials and challenges of emotionally sensitive applications in apprenticeship	2021	Procedia Computer Science	10.1016/j.procs.2021.09.030	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85116934639&doi=10.1016%2fj.procs.2021.09.030&partnerID=40&md5=7df9b524c90d68eb019e79f3a782f96a
Shi W., Li Q.	Human Resources Balanced Allocation Method Based on Deep Learning Algorithm	2021	Scientific Programming	10.1155/2021/4681959	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85116690301&doi=10.1155%2f2021%2f4681959&partnerID=40&md5=8c1e07de3e67ff584def9a09f46ee9a3
Lagorio A., Cimini C., Gaiardelli P.	Reshaping the Concepts of Job Enrichment and Job Enlargement: The Impacts of Lean and Industry 4.0	2021	IFIP Advances in Information and Communication Technology	10.1007/978-3-030-85874-2_79	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85115208711&doi=10.1007%2f978-3-030-85874-2_79&partnerID=40&md5=6755e7a1f4b3670adcd6f2be180d54c3
Zhu H.	Research on Human Resource Recommendation Algorithm Based on Machine Learning	2021	Scientific Programming	10.1155/2021/8387277	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85114704932&doi=10.1155%2f2021%2f8387277&partnerID=40&md5=34efe686a3d94679a910bec029982913
Ellis-Brush K.	Augmenting Coaching Practice through Digital Methods	2021	International Journal of Evidence Based Coaching and Mentoring	10.24384/er2p-4857	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85108668332&doi=10.24384%2fer2p-4857&partnerID=40&md5=6f38a055245edc12da802597aa83e6dd
Mishra S.S., Kunte M., Neelam N., Bhattacharya S., Mulay P.	HR Process Automation: A Bibliometric Analysis	2021	Library Philosophy and Practice		https://www.scopus.com/inward/record.uri?eid=2-s2.0-85108566438&partnerID=40&md5=bc3590224e6b63885788377fe49f4fa5
Pathak S., Solanki V.K.	Impact of Internet of Things and Artificial Intelligence on Human Resource Development	2021	Intelligent Systems Reference Library	10.1007/978-3-030-57835-0_19	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85102029147&doi=10.1007%2f978-3-030-57835-0_19&partnerID=40&md5=4218a8f162662b0298ec314864afd493
Härting R.-C., Schmidt S., Krum D.	Potentials of emotionally sensitive applications using machine learning	2021	Smart Innovation, Systems and Technologies	10.1007/978-981-15-5784-2_17	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85086307169&doi=10.1007%2f978-981-15-5784-2_17&partnerID=40&md5=19bafa0f5e597f940657f33f2c0aed76
Manuti A., Monachino D.	Managing knowledge at the time of artificial intelligence: An explorative study with knowledge workers [Мануті Амелія, Моначіно Даліла. Керування знаннями в добу штучного інтелекту: дослідження інформаційних працівників]	2020	East European Journal of Psycholinguistics	10.29038/EEJPL.2020.7.2.MAN	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85100514162&doi=10.29038%2fEEJPL.2020.7.2.MAN&partnerID=40&md5=15a0a5f4826f4c1e2d96c3c5177d698e

Vysotskaya P., Zabelina S., Kuleshova J., Pinchuk I.	Using the capabilities of artificial intelligence in the development of reflection skills	2020	E3S Web of Conferences	10.1051/e3sconf/202021022035	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85098500673&doi=10.1051%2fe3sconf%2f202021022035&partnerID=40&md5=175b41acb764f8229fb132032ed9ca70
Venusamy K., Krishnan Rajagopal N., Yousoof M.	A study of human resources development through chatbots using artificial intelligence	2020	Proceedings of the 3rd International Conference on Intelligent Sustainable Systems, ICISS 2020	10.1109/ICISS49785.2020.9315881	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85100770552&doi=10.1109%2fICISS49785.2020.9315881&partnerID=40&md5=7e2ccf343c148e266f78f92b934ca2e9
da Silva C.F.D., de Albuquerque A.P.G., de Melo F.J.C., Calábria F.A., de Medeiros D.D.	A fuzzy approach to the strategic development of human capital in the electric sector	2020	Computers and Industrial Engineering	10.1016/j.cie.2020.106787	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85091333939&doi=10.1016%2fj.cie.2020.106787&partnerID=40&md5=7c86588a4abdb26d0d398fd503e8088b
Johnson W.G., Sunderraman R., Bourgeois A.G.	Teaching strategies in software engineering towards industry interview preparedness	2020	ACM International Conference Proceeding Series	10.1145/3442481.3442500	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85103600627&doi=10.1145%2f3442481.3442500&partnerID=40&md5=e8a368f2af8c6cc5a46cdd91a354ab2c
Azarenko N., Kazakov O., Kulagina N., Rodionov D.	The model of human capital development with innovative characteristics in digital economy	2020	IOP Conference Series: Materials Science and Engineering	10.1088/1757-899X/940/1/012032	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85094218137&doi=10.1088%2f1757-899X%2f940%2f1%2f012032&partnerID=40&md5=9ba348a37de58d6af5b3d1a56a65271e
Zel S., Kongar E.	Transforming Digital Employee Experience with Artificial Intelligence	2020	2020 IEEE / ITU International Conference on Artificial Intelligence for Good, AI4G 2020	10.1109/AI4G50087.2020.9311088	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85100337629&doi=10.1109%2fAI4G50087.2020.9311088&partnerID=40&md5=65693d52698e7d3f3beb594dd68f505a
Tian J.	The Human Resources Development Applications of Machine Learning in the View of Artificial Intelligence	2020	2020 IEEE 3rd International Conference on Computer and Communication Engineering Technology, CCET 2020	10.1109/CCET50901.2020.9213113	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85094585411&doi=10.1109%2fCCET50901.2020.9213113&partnerID=40&md5=cc940b0914e4d10d2e0c804e409ef bda
Yorks L., Rotatori D., Sung S., Justice S.	Workplace Reflection in the Age of AI: Materiality, Technology, and Machines	2020	Advances in Developing Human Resources	10.1177/1523422320927299	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85087316834&doi=10.1177%2f1523422320927299&partnerID=40&md5=6f7b43687fe96b3f41845a0a450547c1
Justice S., Morrison E., Yorks L.	Enacting Reflection: A New Approach to Workplace Complexities	2020	Advances in Developing Human Resources	10.1177/1523422320927300	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85086331971&doi=10.1177%2f1523422320927300&partnerID=40&md5=dc5f61bf3e9385f1e1aaca1413e51fd4
Shmatko N., Volkova G.	Bridging the Skill Gap in Robotics: Global and National Environment	2020	SAGE Open	10.1177/2158244020958736	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85091024489&doi=10.1177%2f2158244020958736&partnerID=40&md5=76e69342887c3eeb723c5755588b553f
Xia Y.	Research on Human Resource Development and Training Design Based on ARCS Model	2020	Journal of Physics: Conference Series	10.1088/1742-6596/1533/2/022061	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85087542704&doi=10.1088%2f1742-6596%2f1533%2f2%2f022061&partnerID=40&md5=4215d5e800389bdca9cee8eb1e269442
Chuang Y.-C., Hu S.-K., Liou J.J.H., Tzeng G.-H.	A data-driven madm model for personnel selection and improvement	2020	Technological and Economic Development of Economy	10.3846/tede.2020.12366	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85089114033&doi=10.3846%2ftede.2020.12366&partnerID=40&md5=ac591371a18148774ac2d4da5e9d5b10
Sima V., Gheorghe I.G., Subić J., Nancu D.	Influences of the industry 4.0 revolution on the human capital development and consumer behavior: A systematic review	2020	Sustainability (Switzerland)	10.3390/SU12104035	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85085649184&doi=10.3390%2fSU12104035&partnerID=40&md5=961f6f4459eae311c015ba0c0b098aeb
Rasipuram S., Jayagopi D.B.	Automatic multimodal assessment of soft skills in social interactions: a review	2020	Multimedia Tools and Applications	10.1007/s11042-019-08561-6	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85078490418&doi=10.1007%2fs11042-019-08561-6&partnerID=40&md5=eeb5f326165240a2e66e8d9965bc3797
Mohammadian H.D., Rezaie F.	The role of IoE-Education in the 5th wave theory readiness its effect on SME 4.0 HR competencies	2020	IEEE Global Engineering Education Conference, EDUCON	10.1109/EDUCON45650.2020.9125249	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85084441266&doi=10.1109%2fEDUCON45650.2020.9125249&partnerID=40&md5=11adc35c1c21d2be7c907e590a386c61
Kanatouri S.	The digital coach	2020	The Digital Coach	10.4324/9780429022753	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85107244394&doi=10.4324%2f9780429022753&partnerID=40&md5=a25ceb7b648252f1a43717cebb26109e
Gabrielli S., Rizzi S., Carbone S., Donisi V.	A chatbot-based coaching intervention for adolescents to promote life skills: Pilot study	2020	JMIR Human Factors	10.2196/16762	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85091105700&doi=10.2196%2f16762&partnerID=40&md5=ae2d212df895acbb8a55ea91ab352a2a
Man M.M.K.	Human Resource Development Requirements in Industrial Revolution 4.0	2020	Contemporary Global Issues in Human Resource Management	10.1108/978-1-80043-392-220201011	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85107763589&doi=10.1108%2f978-1-80043-392-220201011&partnerID=40&md5=d05232d252d1a3612dd38d4d51d97ad5
Fleiß J., Bäck E., Thalmann S.	Explainability and the intention to use AI-based conversational agents. An empirical investigation for the case of recruiting	2020	CEUR Workshop Proceedings		https://www.scopus.com/inward/record.uri?eid=2-s2.0-85099264468&partnerID=40&md5=57dea8e21b0f34da29f67dfd87b0a0c7
Lazar R.	Using machine learning methods to conquer one of the last traditional bastion: The human resource department	2020	Society of Petroleum Engineers - Abu Dhabi International Petroleum Exhibition and Conference 2020, ADIP 2020		https://www.scopus.com/inward/record.uri?eid=2-s2.0-85097546050&partnerID=40&md5=60b3c85180da04aec32b375081ceb0a9
Karimulla U., Gupta K., Mashinini M., Nkosi M., Anghel C.	Industry 4.0 and the role of human resource development in the south african fabrication and construction industry	2020	Proceedings of the International Conference on Industrial Engineering and Operations Management		https://www.scopus.com/inward/record.uri?eid=2-s2.0-85096554387&partnerID=40&md5=88318ba337c58d00783dd6586cf1da6b

Terblanche N.	A design framework to create artificial intelligence coaches	2020	International Journal of Evidence Based Coaching and Mentoring	10.24384/b7gs-3h05	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85089540629&doi=10.24384%2fb7gs-3h05&partnerID=40&md5=bab67615d54cf5f93b3b7bc44c37e678
Frost M., Jeske T., Ottersböck N.	Leadership and Corporate Culture as Key Factors for Thriving Digital Change	2020	Advances in Intelligent Systems and Computing	10.1007/978-3-030-51369-6_8	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85088250128&doi=10.1007%2f978-3-030-51369-6_8&partnerID=40&md5=fd980e0f3c452e0721c630826f40564c
Gavriushenko M., Kaikova O., Terziyan V.	Bridging human and machine learning for the needs of collective intelligence development	2020	Procedia Manufacturing	10.1016/j.promfg.2020.02.092	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85084243136&doi=10.1016%2fj.promfg.2020.02.092&partnerID=40&md5=649dc6942226a21bb69ad44087fe4596
Fitrul Hadi A., Permana R., Syafwan H.	Decision Support System in Determining Structural Position Mutations Using Simple Additive Weighting (SAW) Method	2019	Journal of Physics: Conference Series	10.1088/1742-6596/1339/1/012015	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85077811467&doi=10.1088%2f1742-6596%2f1339%2f1%2f012015&partnerID=40&md5=cee088b020815eedb98c50e12ea1b44a
Fachrizal M.R., Radliya N.R., Manik A.	Development of E-Recruitment as a Decision Support System for Employee Recruitment	2019	IOP Conference Series: Materials Science and Engineering	10.1088/1757-899X/662/2/022018	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85075896383&doi=10.1088%2f1757-899X%2f662%2f2%2f022018&partnerID=40&md5=c0cc85af3f17c5fb0c71de3919d23d10
Haga A., Tomida Y., Yamashita A., Matsubayashi K.	Analysis of internal social media for in-house job training aimed at improving the efficiency of human-resource development	2019	Proceedings - 2019 International Conference on Technologies and Applications of Artificial Intelligence, TAAI 2019	10.1109/TAAI48200.2019.8959821	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85079030236&doi=10.1109%2fTAAI48200.2019.8959821&partnerID=40&md5=cb1ece3a5d13e4761e7177102d205111f
Maity S.	Identifying opportunities for artificial intelligence in the evolution of training and development practices	2019	Journal of Management Development	10.1108/JMD-03-2019-0069	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85073233085&doi=10.1108%2fJMD-03-2019-0069&partnerID=40&md5=c75b75577fff44b65233a8d6e0e56e35
Caputo F., Cillo V., Candelo E., Liu Y.	Innovating through digital revolution: The role of soft skills and Big Data in increasing firm performance	2019	Management Decision	10.1108/MD-07-2018-0833	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85060582234&doi=10.1108%2fMD-07-2018-0833&partnerID=40&md5=bc2bbfe56883329eef6847ec9ddc2c84
Sihombing O., Hanoso G.R., Laia Y., Maulana H., Tamba S.P., Nababan M.N.K., Indra E., Batubara M.D., Zendrato N.	Determining Outstanding Employee Using Simple Multi-Attribute Rating Technique Method	2019	Journal of Physics: Conference Series	10.1088/1742-6596/1230/1/012076	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85073419255&doi=10.1088%2f1742-6596%2f1230%2f1%2f012076&partnerID=40&md5=af987df8d12e23df37bf0c5a493d7e1b
Margarov G., Konovalova V.	Interdisciplinary Competencies Needed for Engineers in the Digital Economy	2019	12th International Conference on Computer Science and Information Technologies, CSIT 2019	10.1109/CSITechnol.2019.8895029	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85075634930&doi=10.1109%2fCSITechnol.2019.8895029&partnerID=40&md5=e1050b876b4fdbafa977d36e9f12cf84
Lee J., Suh T., Roy D., Baucus M.	Emerging technology and business model innovation: The case of artificial intelligence	2019	Journal of Open Innovation: Technology, Market, and Complexity	10.3390/joitmc5030044	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85071975465&doi=10.3390%2fjoitmc5030044&partnerID=40&md5=6da210967fd851b5c2f8021e7eb45beb
Tinmaz H., Lee J.H.	A preliminary analysis on Korean University students' readiness level for industry 4.0 revolution	2019	Participatory Educational Research	10.17275/per.19.6.6.1	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85067192341&doi=10.17275%2fper.19.6.6.1&partnerID=40&md5=691cf222c3f0eaf9184cc60b9fc22c3a
Colombo E., Mercorio F., Mezzanzanica M.	AI meets labor market: Exploring the link between automation and skills	2019	Information Economics and Policy	10.1016/j.infoecopol.2019.05.003	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85066431723&doi=10.1016%2fj.infoecopol.2019.05.003&partnerID=40&md5=9dbe32723d6084d4e18cee827e1bf026d
Oktavianti E., Komala N., Nugrahani F.	Simple multi attribute rating technique (SMART) method on employee promotions	2019	Journal of Physics: Conference Series	10.1088/1742-6596/1193/1/012028	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85065602553&doi=10.1088%2f1742-6596%2f1193%2f1%2f012028&partnerID=40&md5=a0ea9d671db608a8a3f557666f9a4e2f
Maddumage C., Senevirathne D., Gayashan I., Shehan T., Sumathipala S.	Intelligent Recruitment System	2019	2019 IEEE 5th International Conference for Convergence in Technology, I2CT 2019	10.1109/I2CT45611.2019.9033836	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85083078422&doi=10.1109%2fI2CT45611.2019.9033836&partnerID=40&md5=fac4fc9fa1c769163686da6e5b77c61d
Stachová K., Papula J., Stacho Z., Kohnová L.	External partnerships in employee education and development as the key to facing industry 4.0 challenges	2019	Sustainability (Switzerland)	10.3390/su11020345	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85059838396&doi=10.3390%2fsu11020345&partnerID=40&md5=449339e4bf6d4103b38f19d8ff4ec612
Williams P.	Does competency-based education with blockchain signal a new mission for universities?	2019	Journal of Higher Education Policy and Management	10.1080/1360080X.2018.1520491	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85053489348&doi=10.1080%2f1360080X.2018.1520491&partnerID=40&md5=3b15e809ab150f61047a055ca00ec908
Lewis L., Clutterbuck D.	Co-evolution: Exploring synergies between Artificial Intelligence (AI) and the supervisor	2019	Coaching Supervision: Advancing Practice, Changing Landscapes	10.4324/9780429282898-15	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85111995061&doi=10.4324%2f9780429282898-15&partnerID=40&md5=f1675b49cd9ecfa09386e53c2652d1b8
Jatobá M., Santos J., Gutierriz I., Moscon D., Fernandes P.O., Teixeira J.P.	Evolution of Artificial Intelligence Research in Human Resources	2019	Procedia Computer Science	10.1016/j.procs.2019.12.165	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85079904026&doi=10.1016%2fj.procs.2019.12.165&partnerID=40&md5=4d573aa04ebf6a227d741410b89ba5d2
Takada E., Saito S., Sakamoto F., Suzuki S., Shibata Y., Yoneda T., Minoda A., Tenzo H., Iwata N., Nakamura I., Yajima K., Nakahira K.T.	Development and improvement of human resource development in nuclear engineering for national college students in Japan	2019	Procedia Computer Science	10.1016/j.procs.2019.09.258	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85076257403&doi=10.1016%2fj.procs.2019.09.258&partnerID=40&md5=886fa697bc49512edb612a6650fddc7b
Wang H., Li H.	Research on theoretical analysis of human capital of labor economics based on artificial intelligence	2019	Journal of Intelligent and Fuzzy Systems	10.3233/JIFS-179127	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85073739246&doi=10.3233%2fJIFS-179127&partnerID=40&md5=628326314367e844ee7b59b33286909d
Stanley D.S., Aggarwal V.	Impact of disruptive technology on human resource management practices	2019	International Journal of Business Continuity and Risk Management	10.1504/ijbcrm.2019.102608	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85073204902&doi=10.1504%2fijbcrm.2019.102608&partnerID=40&md5=4a5c651e6716e8e1e3a3f2ac6ee01e70
Johnson E., Lucas G., Kim P., Gratch J.	Intelligent tutoring system for negotiation skills Training	2019	Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)	10.1007/978-3-030-23207-8_23	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85068332210&doi=10.1007%2f978-3-030-23207-8_23&partnerID=40&md5=13b043785ff3b510aae800ddf7ea140e

Odrekhivskyy M., Pasichnyk V., Rzheuskyi A., Andrunyk V., Nazaruk M., Kunanets O., Tabachyshyn D.	Problems of the intelligent virtual learning environment development	2019	CEUR Workshop Proceedings		https://www.scopus.com/inward/record.uri?eid=2-s2.0-85068041171&partnerID=40&md5=32b423838e9ca332d8b40219a4deed99
Rao M.S.	Soft skills: toward a sanctimonious discipline	2018	On the Horizon	10.1108/OTH-06-2017-0034	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85053420669&doi=10.1108%2fOTH-06-2017-0034&partnerID=40&md5=e0a693e895dc7edffb8ce93598ffd0b9
Muralidhar S., Siegfried R., Gatica-Perez D., Odobez J.-M.	Facing employers and customers: What do gaze and expressions tell about soft skills?	2018	ACM International Conference Proceeding Series	10.1145/3282894.3282925	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85059971715&doi=10.1145%2f3282894.3282925&partnerID=40&md5=c17fbb13c0c5dc6c0ee972b0d692a7ee
Blagodarny E.V., Vedyakhin A.A., Raygorodsky A.M.	Development of Educational Projects on the Basis of Technological Platforms with Artificial Intelligence: The Experience of MIPT on the Use of High Vox-Platform	2018	Proceedings - 2018 International Conference on Artificial Intelligence: Applications and Innovations, IC-AIAI 2018	10.1109/IC-AIAI.2018.8674452	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85064161294&doi=10.1109%2fIC-AIAI.2018.8674452&partnerID=40&md5=19ae0fedea02a34fda80b039a134760e
Sivathanu B., Pillai R.	Smart HR 4.0 – how industry 4.0 is disrupting HR	2018	Human Resource Management International Digest	10.1108/HRMID-04-2018-0059	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85046900158&doi=10.1108%2fHRMID-04-2018-0059&partnerID=40&md5=1cb4a0aa2f731c0b9013b89549c53950
Williamson B., Pykett J., Nemorin S.	Biosocial spaces and neurocomputational governance: brain-based and brain-targeted technologies in education	2018	Discourse	10.1080/01596306.2018.1394421	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85032338223&doi=10.1080%2f01596306.2018.1394421&partnerID=40&md5=4d4336a232e926d3ea155dc739025682
Sayfullina L., Malmi E., Kannala J.	Learning representations for soft skill matching	2018	Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)	10.1007/978-3-030-11027-7_15	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85059931431&doi=10.1007%2f978-3-030-11027-7_15&partnerID=40&md5=53a11c8a6552199b3f0a683ffea797a
Sanchez J.R., Capel M.I., Jiménez C., Rodriguez-Fraile G., Pegalajar M.C.	Personality determination of an individual through neural networks	2018	Communications in Computer and Information Science	10.1007/978-3-319-91473-2_5	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85048246807&doi=10.1007%2f978-3-319-91473-2_5&partnerID=40&md5=4969108e6b11dbe6f64e93ef38b07071
Azzini A., Galimberti A., Marrara S., Ratti E.	A Classifier to Identify Soft Skills in a Researcher Textual Description	2018	Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)	10.1007/978-3-319-77538-8_37	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85044073956&doi=10.1007%2f978-3-319-77538-8_37&partnerID=40&md5=8a50c28e72a9fd03116f0a72db8225c4
Nambiar S.K., Das R., Rasipuram S., Jayagopi D.B.	Automatic generation of actionable feedback towards improving social competency in job interviews	2017	MIE 2017 - Proceedings of the 1st ACM SIGCHI International Workshop on Multimodal Interaction for Education, Co-located with ICMI 2017	10.1145/3139513.3139515	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85046441664&doi=10.1145%2f3139513.3139515&partnerID=40&md5=af8ba6a0ce962dea1dbf237f73674084
Schutt S., Holloway D., Linegar D., Deman D.	Using simulated digital role plays to teach healthcare 'soft skills'	2017	2017 IEEE 5th International Conference on Serious Games and Applications for Health, SeGAH 2017	10.1109/SeGAH.2017.7939254	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85021727249&doi=10.1109%2fSeGAH.2017.7939254&partnerID=40&md5=4e2404828a6bac68b4c32e1692452f25
Cameron G., Cameron D., Megaw G., Bond R., Mulvenna M., O'Neill S., Armour C., McTear M.	Towards a chatbot for digital counselling	2017	HCI 2017: Digital Make Believe - Proceedings of the 31st International BCS Human Computer Interaction Conference, HCI 2017	10.14236/ewic/HCI2017.24	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85048956591&doi=10.14236%2fewic%2fHCI2017.24&partnerID=40&md5=145417f5a050539e11a0f6f61524eb88
Cambria E.	Affective Computing and Sentiment Analysis	2016	IEEE Intelligent Systems	10.1109/MIS.2016.31	https://www.scopus.com/inward/record.uri?eid=2-s2.0-84963783209&doi=10.1109%2fMIS.2016.31&partnerID=40&md5=0f46eaeaa8123e0d2f241bc55901938b
Lane H.C., Core M.G., Hays M.J., Auerbach D., Rosenberg M.	Situated pedagogical authoring: Authoring intelligent tutors from a student's perspective	2015	Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)	10.1007/978-3-319-19773-9_20	https://www.scopus.com/inward/record.uri?eid=2-s2.0-84948990865&doi=10.1007%2f978-3-319-19773-9_20&partnerID=40&md5=21f28aa2f8ad3d1cbe869195c0c16e45
Lee J., Zo H., Lee H.	Smart learning adoption in employees and HRD managers	2014	British Journal of Educational Technology	10.1111/bjet.12210	https://www.scopus.com/inward/record.uri?eid=2-s2.0-84924664229&doi=10.1111%2fbjet.12210&partnerID=40&md5=dc6da7e61af63944d3b7cc9d795d9182
Pasikowska A., Lazzeri N., Zaraki A.	A dialogue with a virtual imaginary interlocutor as a form of a psychological support for well-being	2013	ACM International Conference Proceeding Series	10.1145/2500342.2500359	https://www.scopus.com/inward/record.uri?eid=2-s2.0-84884632301&doi=10.1145%2f2500342.2500359&partnerID=40&md5=f19d1566bc1047ed42ba5ad685eecb5f
Kantola J., Piirto A., Toivonen J., Chang Y., Vanharanta H.	Target training with soft computing tools	2011	Journal of Computational Science	10.1016/j.jocs.2011.05.007	https://www.scopus.com/inward/record.uri?eid=2-s2.0-80052904627&doi=10.1016%2fj.jocs.2011.05.007&partnerID=40&md5=018feb14b17e666f72295f4790ae8dec
Bosse T., Duell R., Memon Z.A., Treur J., Natalie Van Der Wal C.	An agent model for personal development support	2009	Proceedings - 2009 IEEE/WIC/ACM International Conference on Intelligent Agent Technology, IAT 2009	10.1109/WI-IAT.2009.203	https://www.scopus.com/inward/record.uri?eid=2-s2.0-84856704129&doi=10.1109%2fWI-IAT.2009.203&partnerID=40&md5=74cf0de4aae62e3979de43985bffa573
Feng D., Gao Y.	A HRD evaluation method based on BP neural network	2009	2nd International Symposium on Information Science and Engineering, ISISE 2009	10.1109/ISISE.2009.55	https://www.scopus.com/inward/record.uri?eid=2-s2.0-77952664312&doi=10.1109%2fISISE.2009.55&partnerID=40&md5=fcd8392f07269441f0fc5c7dff27a3a9
Fang X., Qi T.	Human resource development by fuzzy neural networks	2008	2008 International Conference on Wireless Communications, Networking and Mobile Computing, WiCOM 2008	10.1109/WiCom.2008.1723	https://www.scopus.com/inward/record.uri?eid=2-s2.0-58049112688&doi=10.1109%2fWiCom.2008.1723&partnerID=40&md5=4756e8a307f6bd8156a3da30c7d90124
Core M.G., Lane H.C., Van Lent M., Gomboc D., Solomon S., Rosenberg M.	Building explainable artificial intelligence systems	2006	Proceedings of the National Conference on Artificial Intelligence		https://www.scopus.com/inward/record.uri?eid=2-s2.0-33750688495&partnerID=40&md5=e7aa4fa775272f92a0ca013e5cd86e47
Garro A., Palopoli L., Ricca F.	Exploiting agents in e-learning and skills management context	2006	AI Communications		https://www.scopus.com/inward/record.uri?eid=2-s2.0-33744927912&partnerID=40&md5=12b7d744cc274c2f43273520523d3215f
Mohaghegh S., Razzazi M.R.	An ontology driven matchmaking process	2004	Intelligent Automation and Control Trends, Principles, and Applications - Proceedings of the Sixth Biannual World Automation Congress, WAC		https://www.scopus.com/inward/record.uri?eid=2-s2.0-3284462328&partnerID=40&md5=bed188de8fd821ae59cb6d4d077614bb
Mockler R.J., Adams J.F., Dologite D.G.	Nurturing professional growth through cognitive mapping: An Asian multinational manager's perspective	2002	Journal of East-West Business	10.1300/J097v08n01_03	https://www.scopus.com/inward/record.uri?eid=2-s2.0-0036413227&doi=10.1300%2fJ097v08n01_03&partnerID=40&md5=8fc94bc305dbbdbdb8b74a344038e6e7
Silveira R.A., Vicari R.M.	Developing distributed intelligent learning environment with JADE– Java agents for distance education framework	2002	Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)	10.1007/3-540-47987-2_15	https://www.scopus.com/inward/record.uri?eid=2-s2.0-84943269937&doi=10.1007%2f3-540-47987-2_15&partnerID=40&md5=ff591d35c54c075a54ecd3dcc6a2714e
Silveira R.A., Vicari R.M.	Improving interactivity in E-learning systems with Multi-Agent Architecture	2002	Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)	10.1007/3-540-47952-x_62	https://www.scopus.com/inward/record.uri?eid=2-s2.0-84874843916&doi=10.1007%2f3-540-47952-x_62&partnerID=40&md5=200ac07de97630364fae1d20adc251e7